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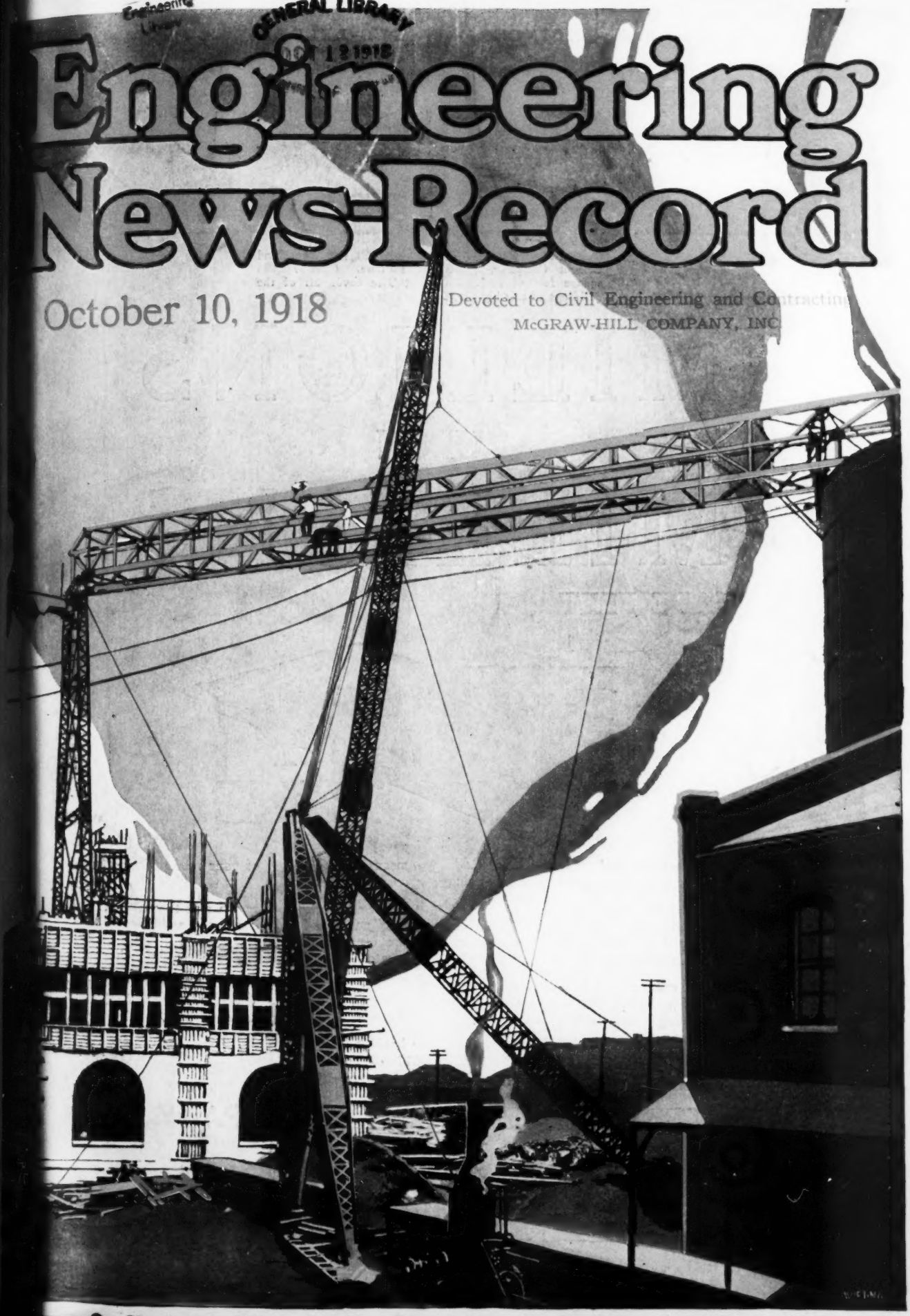

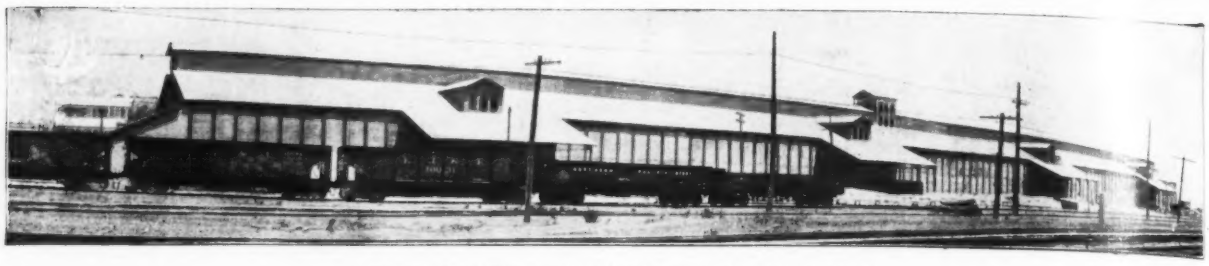

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Volume 81 October 10, 1918 Number 15

Engineering News-Record

A CONSOLIDATION OF ENGINEERING NEWS AND ENGINEERING RECORD, WITH WHICH IS INCORPORATED THE CONTRACTOR.

E. J. MEHREN, *Editor*

CHARLES WHITING BAKER, *Consulting Editor*

Fourth Successive Hydro-Electric Plant Nears Completion at Rumford, Maine 654

DEVELOPMENT began in 1892, and capacity has been increased from 200 to 30,000 horsepower in four steps—Hydraulic conditions unusually favorable—Provision for future growth.

Engineering News-Record, Oct. 10, 1918. 8 cols. Ill.

Development Committee of American Society Appointed 658

ONWARD BATES chairman of board of twenty-eight—President Talbot gives his conception of purpose, procedure and field of committee.

Engineering News-Record, Oct. 10, 1918. 5 cols.

Should Treat all Sewage Going into Boundary Waters 660

INTERNATIONAL JOINT COMMISSION sets tentative standard for safe load on water filters—Recommends it be given control over pollution.

Engineering News-Record, Oct. 10, 1918. 5¼ cols.

Pavement Construction and Maintenance Considered 665

ABSTRACTS OF PAPERS read before the American Society for Municipal Improvements at Buffalo last week, prefaced by extracts from presidential address.

Engineering News-Record, Oct. 10, 1918. 7 cols. Ill.

Recent Erie Flood Similar to Inundation of 1915 667

BY FARLEY GANNETT.

THOUGH of greater intensity, 1918 storm was of shorter duration—Flood prevention structures helped.

Engineering News-Record, Oct. 10, 1918. 2¼ cols. Ill.

Valuation of the Railroads—Is It Worth While? 668

BY A FORMER GENERAL MANAGER.

LIKELY TO COST $50,000,000 more without helping win the war—Should be discontinued, at least until the war ends.

Engineering News-Record, Oct. 10, 1918. 2¼ cols.

Heavy Rainfall Tests Mill Creek Sewer at St. Louis 669

BY W. W. HORNER.

RELIEF SEWER pressure tunnel comes into full play—Automatic water-level recording gages found useful.

Engineering News-Record, Oct. 10, 1918. 1¼ cols.

Build Filters for Fighters in France from Odds and Ends 670

GREATEST DIFFICULTIES are uncertainty of delivery and scarcity of supplies—Design layouts to fit four types of filters.

Engineering News-Record, Oct. 10, 1918. 2¼ cols. Ill.

Plant Prepares Slag for Roads and Concrete 671

MATERIAL combines strength with light weight—Crushing, screening and iron removal form principal treatment.

Engineering News-Record, Oct. 10, 1918. 1¾ cols. Ill.

What and Where to Buy 150

Searchlight Section

Extraordinary Rainfall Flooded Portions of St. Louis 672

BY W. W. HORNER.

VALUE OF NUMEROUS gages shown—Maximum record of 3.6 inch in one hour more than double Weather Bureau record.

Engineering News-Record, Oct. 10, 1918. 3 cols. Ill.

What Causes Railway Curve Resistance? 673

Engineering News-Record, Oct. 10, 1918. ¾ col.

Engineering Colleges Teach Fighting Mechanics for Army 674

HOUSING, EQUIPMENT, instruction staff and curricula quickly assembled—Automobile mechanics made in eight weeks.

Engineering News-Record, Oct. 10, 1918. 6¼ cols. Ill.

Concrete Floors Combine Steel and Concrete Frame 677

SLAB-AND-JOIST construction carrying loads of 300 pounds to 150 pounds has minimum spacing of 4½ inches between joists.

Engineering News-Record, Oct. 10, 1918. 2¾ cols. Ill.

Steel Derrick with 132-Foot Boom Handles 122-Foot Trusses 678

Engineering News-Record, Oct. 10, 1918. ¾ col. Ill.

Machines Dress Railroad Ties Before Treatment 679

SANTA FE has both stationary and portable plants that saw, adze, bore and brand ties in one continuous cycle.

Engineering News-Record, Oct. 10, 1918. 3¼ cols. Ill.

Concreting Plants Standardized for Five Miami Valley Dams 680

PIT GRAVEL washed and screened to three sizes including sand at each dam—All processes mechanical from pit to forms.

Engineering News-Record, Oct. 10, 1918. 3¾ cols. Ill.

Hints for the Contractor 685

Other Articles of Interest to Contractors:

Plant Prepared Slag for Roads and Concrete

Steel Derrick With 132-Foot Boom Handles 122-Foot Trusses

Concreting Plants Standardized for Five Miami Valley Dams

Editorials 651

Society Service 682

Letters to the Editor 683

News of the Week 686

News of Engineering Industries 693

Construction News 187

Index to Advertisers 156

63-93

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Published Weekly. Entered as second-class matter Apr. 11, 1917, at the Post Office at New York under the act of Mar. 3, 1879.

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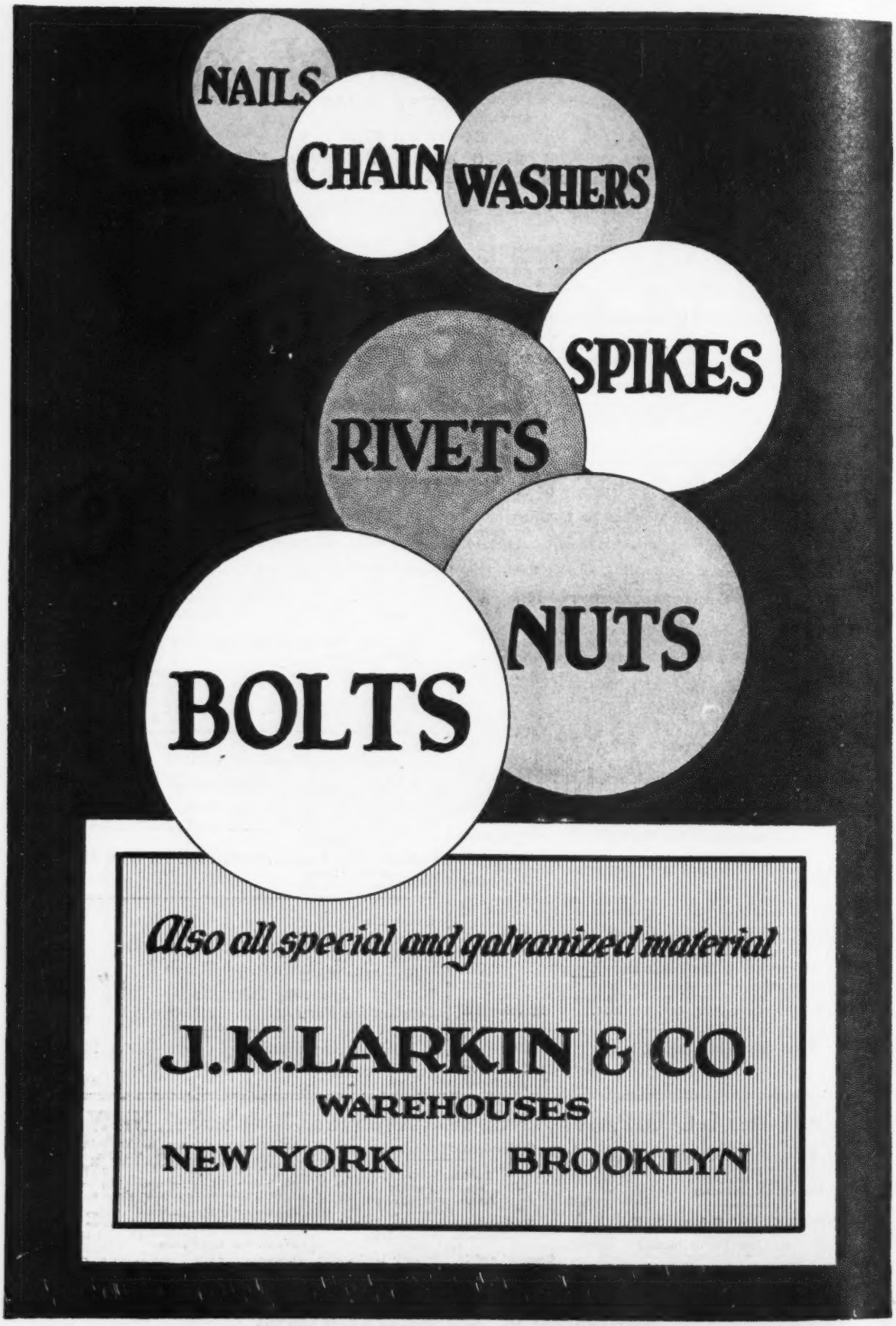
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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN, *Editor* — CHARLES WHITING BAKER, *Consulting Editor*

Volume 81 — NEW YORK, THURSDAY, OCTOBER 10, 1918 — Number 15

Preparing the Profession for a Great Opportunity

The Task of the Civil Engineers' Development Committee

ANNOUNCEMENT has been made of the personnel of the development committee of the American Society of Civil Engineers. Since the resolution creating the committee was passed the members of the society have had a chance to think, and that thinking has served to show the inadequacy for present and future needs of the society's structure. Free from the trammels of detail, they see clearly the needs of the time, and are ready to accept any change, no matter how drastic, provided it fit the society for a worthy part in the wonderful, if troublous, times that are ahead. In fact, they are not only ready to accept an advanced program, but will unhesitatingly reject a weak plan, designed merely to save an antiquated structure.

Let there be no mistake as to the temper of the members or the attitude of mind that the times demand. The development committee's first task is to get away from details and to see clearly the place of the engineer in the new economic and social order. When that is determined, the details will fall into place without effort. President Wilson has specified our peace terms as broad principles only. He will not be drawn into a discussion of details, for details becloud issues. Once the enemy accepts the principles there will be no difficulty about such matters as territorial control and the setting up of new nations. So with the development committee. It must express for the profession its great aim and purpose. That aim and purpose must be so broad, so appealing that it will command instant support and be full justification for the radical rebuilding, if necessary, of the entire structure.

* * * * * *

What will be that great aim and purpose? It is for the committee to say, but we feel positive that it will revolve about the obligations of the profession and the individual to the public. The weakness of our national engineering societies is their selfish purpose, clearly expressed in their constitutions. The new order in engineering organization will recognize that our whole social structure—save what rests on agriculture—is built on and determined by industry. And industry is the creation of engineering. Our laws are made to facilitate and regulate the industrial process and to protect the individual against its abuses.

The industrial structure is to be recast; it was due for recasting even if the war had not come. Those who have controlled it hitherto—the bankers—have made a colossal failure of it; witness the railroads, the attitude of labor, the growth of radicalism. After the war there will be those with solutions to offer. Philanthropists and economists will want to lead, but we who have seen their works will rightfully look askance.

The one true method of attack is a scientific study of all the factors—a scientific study of a structure to be reared on an engineering basis and to function as part of an engineering process.

Can the right solution be reached without the aid of the engineer?

* * * * * *

On other points, also, we feel certain. One is that the autocratic government of the society is at an end. That has been apparent for many a year. In these days a society cannot be strong by merely having a strong headquarters organization—autocratic strength. Real strength, democratic strength, is rooted in virile local and state bodies. National influence is local influence everywhere exercised. Local autonomy is demanded and a delegate body faithfully representative of the autonomous locals. So only can there be a society responsive to the needs, and virile enough to grasp opportunities; so only can there be national influence.

* * * * * *

Yet another point is perfectly clear. The committee cannot discharge its duty properly without laying down an ideal for the whole profession. There will be no desire to *interfere* in the affairs of other bodies, National and local; it will simply be impossible to do a decent job without scrutinizing those other bodies and fitting them into the big plan. Any failure to do that will, of the very fact, condemn the report as inadequate.

No plan less than the integration of the whole profession can possibly be adequate to the opportunities—and responsibilities—of the dawning day.

* * * * * *

Furthermore, we have to urge on the development committee the adoption of open and well-advertised meetings of the full committee and of its principal subcommittees. Through such procedure its work would stimulate the thinking of the members and guarantee in advance the acceptance of the final program. President Wilson's reliance for a permanent peace lies in telling the whole truth to all the peoples of the world. Therefore the deliberations of the peace table will be open, that the peace may be written in the hearts of mankind.

Shall not our revision be worked out in the light of

day, that all may know, that the white heat of society-wide study and criticism may refine and improve and bring forth a truly great result?

* * * * * *

Finally, we believe that the development committee holds in its hands the future of the society. If the report does not bring about a rebirth, if it be weak and halting, the society will dwindle into an innocuous technical body and the virility of American engineering will find expression through a new society, raised by the progressive elements in American engineering to accomplish the great purpose.

Support Our Engineers!

OUR engineers have won conspicuous mention in cabled accounts of recent successes on the western front. They have shown the American will and knowledge to do which achieves its aim. Appreciation of these services can take no more expressive form than heavy oversubscriptions to the Fourth Liberty Loan.

College Readjustment

PROBLEMS of readjustment dominate our engineering schools today. It cannot yet be said how many students will take war engineering courses and how many regular work, nor to what extent the two groups will be merged in the classrooms. But it is certain that instructors and students are alive to the needs of the hour.

An Enemy Ally

INFLUENZA is an ally of the enemy. Were it to grip the whole country our war industries would be crippled, our training camps paralyzed, our shipments of troops and supplies overseas heavily curtailed and the surrender of Germany delayed. A patriotic duty of each of us is to see that he does his part in stopping the spread of the scourge. Suggestions to this end were made on p. 607 of our issue of last week.

Reconstruction

APPOINTMENT by President Wilson of a reconstruction commission is urged in a resolution adopted by the American Society for Municipal Improvements last week. Such action has been advocated in these columns for months past. While fighting our way to world freedom we should no longer delay plans for solving the many reconstruction problems which peace will surely bring. This applies also to the municipal field, as was urged by N. S. Sprague in the address abstracted on p. 663.

Water Meter Prospects Are Good at Philadelphia

PROSPECTS for a universal water meter system in Philadelphia within a few years are good. Three ordinances to that end have been introduced in the city councils. The most promising one is printed on p. (?). It is theoretically objectionable in that it provides for private instead of city ownership of the meters, but the financial condition of Philadelphia seems to make such a plan imperative, and as the city would install and control the meter the case is far from bad. The press, civic organizations and many commercial interests favor universal meters. The sooner such a system is adopted the quicker will the strain be taken from Philadelphia's pumping and filtration plants, her enormous water consumption and coal bills be cut down, and a fair means of paying for water be introduced.

The Things That Count

NO PEACE proposal from Germany, however specious, can be heeded by the engineers of this country till we read the news of unconditional surrender forced by our armies in the field. Throughout more than four years of war the German government has consistently and adequately demonstrated that it cannot be trusted. However it may hide behind statesmen formerly in disfavor because of their "liberal" views, we know Potsdam is using these men as tools to rake out of the fire what of autocracy might yet be saved. However its lips may repeat, parrot-like, the words of our own President, we know them for a decoy to lure us within reach of German claws around a German "peace" table.

The only successful way to discuss peace with such an enemy is across a thousand miles of battle front with divisions as superior in numbers as they already are in spirit, with an overwhelming preponderance of artillery and the engines of war, supplied and maintained by increasing production and adequate transportation.

Engineers are responsible for this production and transportation. The country looks to their organizing and producing genius for guns, equipment, munitions, airplanes, rolling stock, ships, the terminals and factories and railroads to increase the flow of these things into a tide that will sweep over the foe of civilization and blot out forever all trace of its sinister influence.

Now the country must look to her engineers for something more. Theirs is the job of flattening the rosy insinuations of "peace," made in Germany, which are designed by their authors to paralyze our production, to interfere with the loan now being raised to increase that production, and to draw us, unthinking, into a "peace" discussion during which Germany will grow stronger as we slacken our effort, and from which it can emerge intact, to heal its wounds against the day when it will again be ready to assault the peace of civilization.

Nail down the idea that Potsdam is ready to quit. Do not allow it to show its head in your plant, on your job, among your staff. If that idea takes hold in America, it will be a worse defeat than if our forces in France had been blotted out overnight. If, by calling in a few political tools who have shown liberal tendencies at times, and by emitting a cloud of poisoned words whose sincerity is disproved by an unbroken succession of crimes, Berlin can make us pause, the Kaiser will have already avoided the necessity of quitting.

The end of the war is in sight—a real end, which will be the grave for all time of the ideals and methods of the outlaws who at this moment control more surely than ever the policies of the German empire. But this end is going to be forced by the quickening of every phase of war production—never can we reach it by accepting the poisoned gifts offered us today on the Kaiser's silver platter.

At the moment, German surrender talk is not worth the ink being wasted on it in our own newspapers. Two things count—and we look to our engineers for a

man's share in the accomplishment of both—put the Fourth Liberty Loan over the top and quicken production till our boys in France have war material enough to pave the Junker's way from Belgium to oblivion, and to hurl him down it.

Rational View of Sewage Disposal Held by Joint Commission

MUNICIPALITIES generally and particularly those located on the waters between the United States and Canada may congratulate themselves on the rational view of sewage disposal shown in the final report of the International Joint Commission. True, the Commission holds that all sewage discharged into those waters should be treated, but it leaves for determination in accordance with local sanitary and economic conditions the degree of treatment in each case, except that it proposes a tentative standard for use where public water-supplies are involved. Even here the standard is no arbitrary rule expressed in terms of the character of sewage effluent. Instead, the intent is to insure a sewage effluent that will not pollute the water course beyond the safe working load of water-purification plants.

Notable is the assumption that a water-purification plant will be provided wherever there is a public water-supply to be protected from sewage pollution. This is in striking contrast with contentions long current in some quarters that sewage must be so treated as to bring it to a drinking-water standard. Providing safe drinking water, the commission rightly assumes, is the function of water purification, not of sewage treatment.

Significant and fortunate is it that the tentative standard of bacterial burden placed on water filters by sewage effluent appears to be readily attained by a sewage dilution, or a sewage treatment equivalent to a dilution, which will insure absence of nuisance. Thus if pollution is kept sufficiently low to prevent a nuisance it will not be an undue burden on a water-purification plant—broadly speaking. The degree of dilution proposed by Professor Phelps as an equivalent to the tentative bacterial standard is the same as was advised nearly thirty years ago for Chicago by Rudolph Hering at a time when bacteria were only beginning to be considered as an objective in either water or sewage treatment.

That the tentative standard safe bacterial load for a water-purification plant recommended by the Commission, on the advice of its advisory engineers—an annual average of 500 B. coli per 100 c.c.—will prove to be more than tentative seems unlikely. Further study of boundary waters is needed, as the Commission's own engineers realize, to differentiate soil and grain bacilli, thus possibly lessening the significance of B. coli. It may yet be found, as was suggested at the meeting of the American Society of Municipal Improvements Oct. 3, that with the lowering typhoid rates so notable in the last few years more than 500 B. coli per 100 c.c. would be permissible, since these germs are only an indication that those of typhoid may also be present.

Engineers, Rudolph Hering urged, should go slow in spending millions of the people's money to reduce the bacterial load on water filters until more is known of the real significance of the B. coli in water. To this we may add that there will be all the more need for caution in making heavy expenditures for sewage treatment during the coming reconstruction period in view of the huge outlays that must then be made.

For the present and probably for all time water purification will afford far better insurance against sewage pollution than will sewage treatment. But no mistake can be made in planning sewage-works which may be extended from time to time in order to provide any desired degree of treatment.

The Commission, aided by its able engineers and other sanitary advisors, has contributed in no small degree to the enlarged rational view of sewage disposal which recognizes that each sewage-disposal problem is a law unto itself, controlled by a variety of local economic and sanitary conditions, and that so far as public health is concerned water purification is the main line of defense.

War May Put Railway Track Work on a New Basis

AS A result of war conditions railway maintenance of way seems likely to attain a higher plane and to be accorded the attention which its importance to railway service demands. Such result will come, however only through a trying and strenuous period of change. This radical change has been foreshadowed for some time and is indicated anew by the proceedings of the recent Roadmasters' and Maintenance-of-Way Association's convention.

These war conditions have compelled attention particularly to the vexed problem of labor supply and labor efficiency in railway track work. A direct outcome of this is the establishment of higher wages and the introduction of new methods of obtaining and controlling labor. This, together with the growing tendency to distribute maintenance work over the entire year instead of concentrating it within a few busy months, may mean that railway maintenance will become a field for permanent gangs rather than for the shifting and ever-changing forces which have been characteristic of American railway service.

Supplementary to this is the wider consideration and use of labor-saving machinery and appliances which is the opening of a broad field of development. Such devices serve two different purposes. They may release men for military or other essential service, and they may enable a small force to do as much work and as good work as a larger force without such equipment. Furthermore, they may result in better work and greater permanence with consequent reduction in maintenance and increase in economy. Appliances that contribute to the stability of the track may be classed as labor-saving devices from the fact that they tend to reduce the amount of maintenance work required.

Conservation of material used in track is another improvement forced by the shortage due to war conditions. Special care must be given to the proper use of existing supplies in order to make the most of what we have and avoid all unnecessary requisitioning of new material which is badly needed for other purposes. Much old material which once would have gone for scrap can be made available for use again if proper care is given to it. That which cannot be utilized directly must be collected to add to our stores of raw material.

Fourth Successive Hydro-Electric Plant Nears Completion at Rumford, Maine

Development Began in 1892, and Capacity Has Been Increased from 200 to 30,000 Horsepower in Four Steps—Hydraulic Conditions Unusually Favorable—Provision for Future Growth

ON THE Androscoggin River at Rumford, Me., the Rumford Falls Power Co. is now bringing to completion the fourth hydro-electric plant at this particular site. Each of the earlier plants gave way to a larger installation as the market for power developed, and each made use of the improvements in hydraulic and electric practice since the completion of its predecessor. The latest plant is built so that it can be extended to utilize the full normal regulated flow of the stream. Two new units are now installed, while two of the earlier ones are continued in use. This gives all the capacity, 30,000 hp., for which there is either immediate or immediately prospective demand. Moreover, this is the total capacity available with the present storage at the headwaters. Increase in the plant by the later addition of three new large units is dependent on further storage development on the stream or change of load.

The features of the plant are the historical associations referred to, the completeness of the new installation and the exceptionally favorable hydraulic conditions.

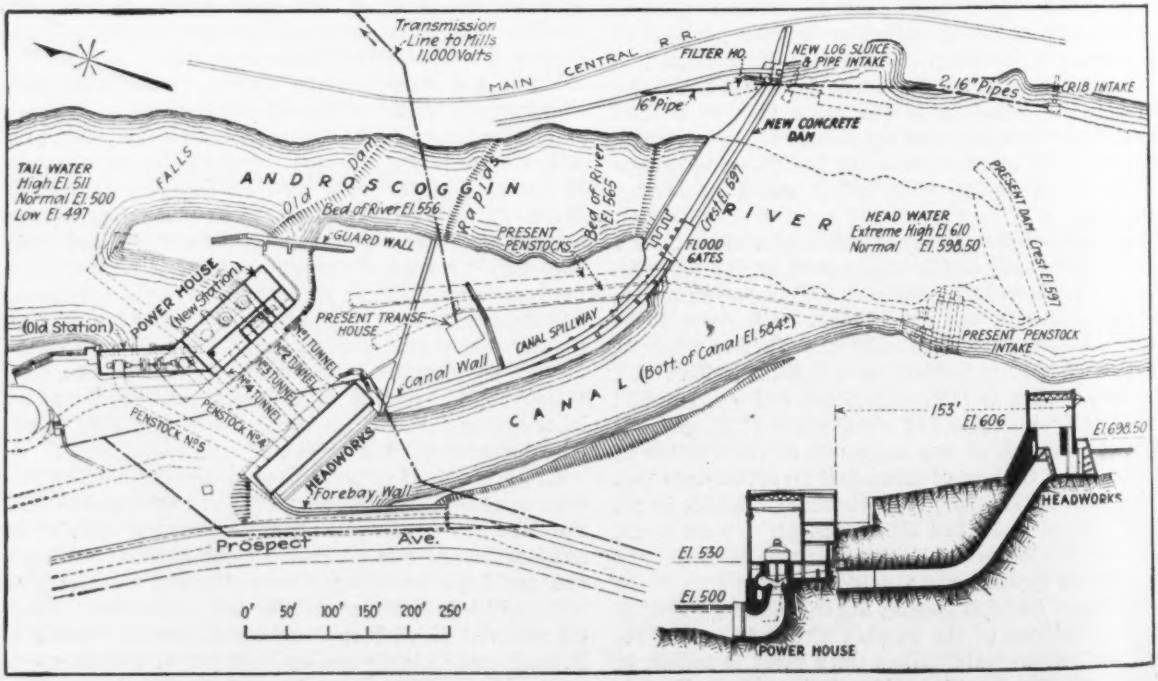
Rumford Falls consists of a series of three rapids extending over a distance of about a mile, the total drop being 180 ft. The fall over the first group, 100 ft., is that developed in the hydro-electric plant herein described, and is obtained with the aid of a dam 25 ft. high at the head of the rapids. The second drop, 50 ft., is used chiefly mechanically in the mill of the International Paper Co., a small part of the power being converted into electric energy, for use, however, in the mill itself. The remaining 30-ft. drop is developed mechanically within the mill of the Oxford Paper Co., which finds it necessary, in addition, to buy electric power from the Rumford Falls Power Company.

Excluding a very crude wheel installed more than a hundred years ago, the development began in 1892. The designs were those of J. Herbert Shedd of Providence, R. I., then one of the leading hydraulic engineers of New England. The first unit consisted of a 200-hp. wheel, belted to four generators and using only 55 ft. of the available 100-ft. head. The rapids at this drop are divided by a shelf which afforded an excellent opportunity for taking off water at the 55-ft. level without the use of a dam.

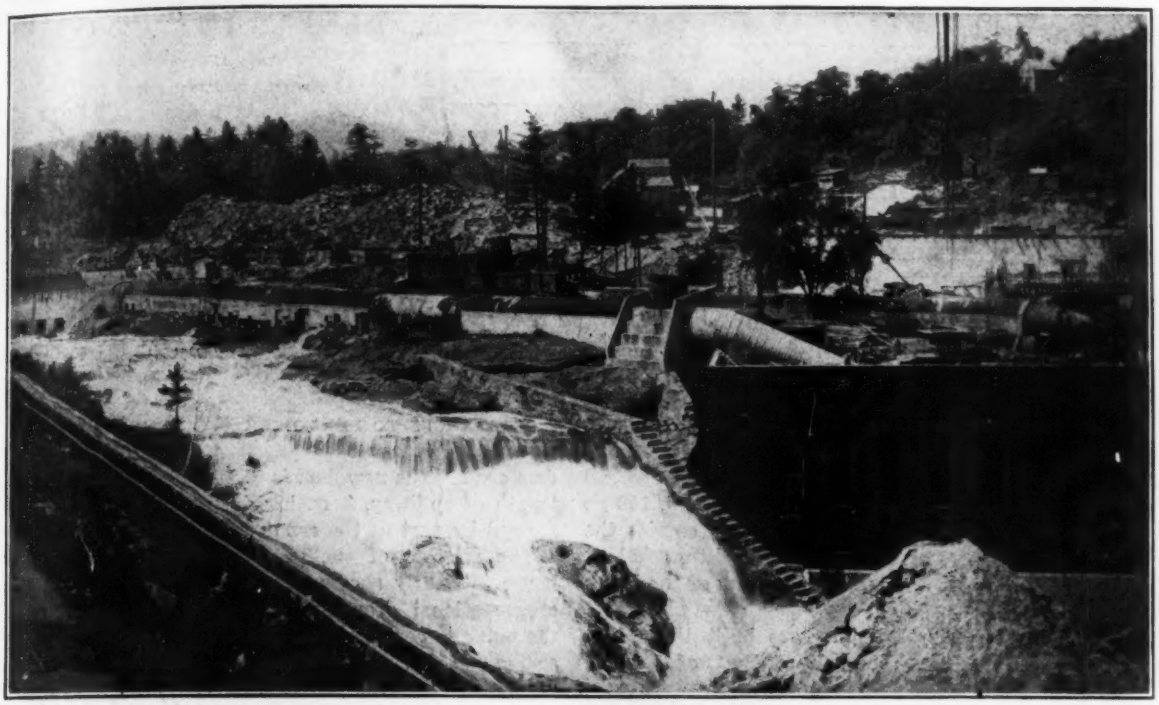
When the market justified it this wheel was supplemented by a 600-hp. double-runner horizontal-shaft unit also operating under 55-ft. head. Like all the subsequent wheels, except the two just now put in service, the turbine was a Hercules, built by the Holyoke Machine Works. Then followed soon an 800-hp. unit and then the substitution of an 800-hp. for the first 600 machine and of a 1200 for the 200.

The third stage of the development, starting in 1908, was an important one; the full fall, 100 ft., was used, the water being brought to the new wheel, a 5000-hp. horizontal shaft pair, through a 13-ft. penstock, 1125 ft. long.

There had been constructed at the head of the rapids



PLAN SHOWS RELATION BETWEEN NEW HEADWORKS AND POWER HOUSE SERVED BY CANAL



LOOKING UPSTREAM AT NEW WORK WITH NEW POWER HOUSE SEEN PRACTICALLY COMPLETED ON RIGHT

in 1892 a 25-ft. timber-crib dam, with the purpose of creating a pond from which logs were sent into a canal running to a paper mill below. A concrete intake for the penstock was built at one end of this structure. In 1910 a 14-ft. penstock was added, serving two new wheels, of 3000- and of 5000-hp. capacity, these two superseding the 1200- and the two 800-hp. units of the second development.

The final step of the third stage came with the changing of the 5000-hp. runners to 6000, using the same casings. This could be done without changing the generators, for at the time of installation it was found economical to buy certain standard generators, though they were somewhat greater in capacity than the wheels chosen. The plant, then, when the present installation was begun consisted of one 3000- and two 6000-hp. units. Of these the two 6000's are being retained, being augmented by the two 9000-hp. wheels, giving a total plant capacity of 30,000.

Hydraulic Conditions

Hydraulically (as well as electrically) the plant operates under favorable conditions. The demand at Rumford is chiefly for 24-hour power—for electric furnaces and paper mills—so that storage for heavy peaks or for part-day demand is not needed. Consequently, the chief service of a pond (the one created by the dam is about 8 miles long) is the prevention of ice troubles, from which the plant has been entirely free.

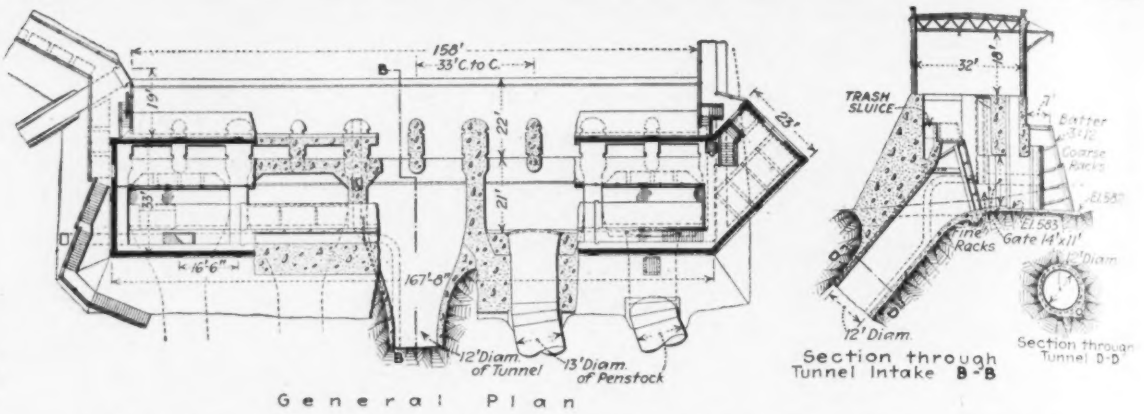
Seasonal storage is afforded by a system of lakes—the Rangeley chain—for which the Androscoggin River forms the outlet. These have been improved by regulating dams at each lake, raising the natural level 4 ft. in one case, 12 ft. in another, 20 ft. in three of them and 45 ft. in one, creating an available storage capacity of 30,000,000,000 cu.ft., with a surface area of 125 square miles. This storage system has been developed jointly by four of the interests on the river. the Union Water Power Co., Lewiston, Me.; the Brown Corporation, Berlin, N. H.; the International Paper Co., Berlin, Rumford and Chisholm, and the Rumford Falls Power Co., owner of the hydro-electric development herein described. The amount of water released to the river is fixed by agreement among these parties at a minimum of 1550 sec.-ft. at Berlin, but at Rumford it has not been less than 1850. The ultimate limit, therefore, of the new plant at Rumford is set by this amount of water, plus the run-off from the basins below the lakes, some 84 miles above Rumford.

Further storage, however, can be created, and will probably be taken in hand as the demand for power on the stream increases. The capacity now provided by the reservoirs takes into account the many conditions incident to such a problem and all the reservoirs are normally filled annually. The storage system was developed under the direction of Walter H. Sawyer, Lewiston, engineer and agent of the Union Water Power Company.

New Plant

The chief differences between the present development and its immediate predecessor (two wheels of which, as above noted, are to be kept in service) are the substitution of a canal and concrete-lined tunnels for the long steel penstocks, and the use of vertical-shaft instead of horizontal-shaft units. Needless to say, there are many minor differences and improvements, embodying the advances in practice since the third installation was designed.

An accompanying plan drawing shows the major changes in the physical layout. The old dam is drowned out, though the crest of the new structure is at the



PLAN AND SECTIONS OF NEW HEADWORKS SHOW ENTR ANCES TO PENSTOCKS AND TUNNELS

same level as the old, there being no advantage, all things considered, in raising the crest. A canal, 100 ft. wide and 15 ft. deep, blasted out of rock, carries the water to a gatehouse, whence concrete-lined tunnels lead to the wheels and power house on the bank of the lower river.

All the structures rest on or are built through a solid granitic ledge, which lies so that it was of material

NEW CANAL WITH POWER HOUSE ON LEFT—WATER RAISED TO SUBMERGE PARTLY OLD PENSTOCKS

assistance in obtaining a canal location. Approximately 47,270 cu.yd. of rock were taken out of the canal excavation, most of it being used in the concrete of the dam, canal wall and other structures. The canal wall for 250 ft. of its length is of spillway section, 3 ft. higher than the crest of the dam section, affording additional capacity for passing freshets.

For the dam, a solid concrete structure was chosen, the maximum height being 40 ft. Four sluice gates, both power- and hand-operated, are reached from a girder-and-slab bridge supported by piers carried on the canal wall. The spillway capacity provided by the dam and overflow section of the canal wall is approximately equal to that of the older structure, which successfully passed the maximum flood of 55,000 sec.-ft. with 10 ft. of water on the crest of the dam proper. The old spillway consisted not only of the dam itself but of the canal wall at the old intake, the ledge of rock on the right bank and a crib dam beyond, a length of about 500 ft., the rock section being about 3 ft. above the dam crest. The new dam is 250 ft. long, while an equal length of spillway, 3 ft. higher than the dam crest, is formed by part of the canal wall.

The relation of the gatehouse, tunnels and power house is clearly shown in the accompanying plan and cross-sectional drawings. Of the two sets of racks the outer is composed of bars 5 in. apart for catching coarse material, and the inner has 2¾-in. spacing. Trash discharge flumes are provided for both sets.

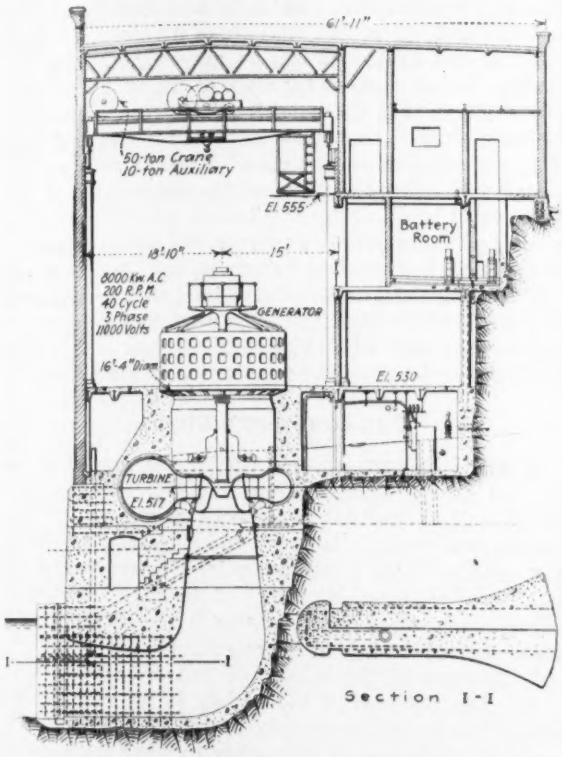
Three tunnels have been excavated and two of them completed by a reinforced-concrete lining; and the power house is so built that the third unit can be installed without altering or adding to the structure. For the fourth and fifth units the tunnels are started at each end; the gatehouse structure is complete, but the power house will be extended to accommodate them after the two horizontal units are removed. It will be noted that the headworks for the fourth and fifth units are now used for the two old units continued in service. Sections of the old penstock are used for building the new penstocks, leading from intakes 4 and 5 in the new gatehouse to the old wheels. These will be removed and the old power house dismantled

OLD DAM AND PENSTOCKS—WORKING ON NEW DAM IN FOREGROUND

when the power market demands the extension of the new station.

Each of the two new units consists of a Westinghouse generator of 6500-kw. rated capacity, a 9000-hp. Wellman-Seaver-Morgan turbine, and a 95-kw. exciter, all supported on a Kingsbury bearing, mounted above

the generator. Though rated at 6500 kw. the generators have a continuous capacity of 8000 because of the special mica insulation used. It is expected that the wheels will run above the guarantee and that the reserve electrical capacity will thus be utilized. Separate excitation is provided by an independent water-wheel unit, the penstock of which is carried in the tunnel excava-



CROSS-SECTION OF NEW POWER HOUSE

tion for unit No. 2. Generation is at 11,000 volts, which is also the line voltage. Maximum length of transmission is only 6000 ft. However, with future exigencies in view, the line equipment is built so that 22,000 volts can eventually be used. The General Electric Co. built the switchboard, the oil switches and the other equipment pertaining to the control. The older units generate at 2300 volts stepped up to line voltage through Allis-Chalmers transformers.

The auxiliary equipment of the governors, pumps, filters, etc., has no special novelties. All the equipment is housed conveniently in fire-resisting structures.

One of the essential conditions met in designing the new plant was, of course, that the old plant must at all times be kept in operation during the period of construction. This condition was particularly difficult to comply with from the fact that the new canal necessarily had to cross the line of the old penstocks, and the conduits supplying water from the end of the new canal to the new turbines again had to cross the line of the old penstocks. These penstocks had to be retained in operation and the new units placed in regular service before the old units could be temporarily shut down and the penstocks removed and reconstructed to connect the turbines with the new canal.

These conditions, together with other considerations, suggested the use of tunnels driven through the rock from the new headgates to the new units, which would be passed beneath the line of the old penstocks and would not interfere with their temporary use.

A condition was foreseen where the canal would be filled with water for operating the new units before the old units were shut down, and during this period those portions of the old penstocks which crossed the canal would be submerged. As it was frequently necessary to empty them for making inspection and repairs to the old turbines, the problem of keeping them from floating had to be considered. This was accomplished by constructing a temporary forebay of small area around the old penstocks at the point where they passed through the new canal wall, cutting the penstocks inside the temporary forebay and inserting temporary gates at this point, in order that the tubes could be emptied below the gates and always kept filled where they were submerged.

All the power required for the construction work, amounting at times to more than 700 hp.—for the operation of cableways, rock drills, derricks, pumps, carpenter shop, stone crushers, concrete mixers, etc.—has been supplied by the operating station. No fuel was used except a little in winter for heating. About half the construction equipment was driven by electric motors, and half by compressed air from an ample compressor plant driven by one of the small generators removed from the station and used as a synchronous motor.

The new plant is being built under the general direction of Hugh J. Chisholm, president of the Rumford Falls Power Co., to whose vision is due the replacement of the older plant with the present modern development, thus carrying on the policy of his deceased father, Hugh J. Chisholm, Sr., in keeping the development in step with advances in the art. H. S. Ferguson, New York, designed the new work, which was built under the immediate direction of Charles A. Mixer, engineer of the Rumford Falls Power Co. N. J. Neall, Boston, now in Government service, was the consulting electrical engineer. Originally the work was let to the H. P. Cummings Construction Co., contractor, Ware, Mass.; but the war made it advisable to complete the work under force account.

At the time of writing the two new units are in operation as well as the two earlier ones, the new penstock connections having been completed. One section of the dam remains to be finished.

High Typhoid Rates Not Due to City Water

In Terre Haute, Ind., the water company purveys a filtered water approved by the State Board of Health, which takes samples weekly, and by the United States Public Health Service. The city is built over a sandy soil from which water is easy to get. In consequence there are numerous wells, privy vaults and plenty of typhoid. Rates per 100,000 for the 10-year period which ended with 1917 are as follows: 34, 59, 26, 29, 27, 26, 25, 21, 25 and 15. Excluding fatal cases where there was no city water on the premises, and imported cases, the corresponding rates for the same period were: 0, 8.6, 7, 1.7, 5, 3.4, 3.3, 1.6, 4.6 and 3.

Development Committee of American Society Appointed

Onward Bates Chairman of Board of Twenty-eight—President Talbot Gives His Conception of Purpose, Procedure and Field of Committee

APPOINTMENTS have been completed to the committee on development of the American Society of Civil Engineers. The committee is expected to prepare a program of work and to propose topics for discussion by Nov. 1, the date set for a preliminary report in the resolutions which gave rise to the committee and which were passed by the board of direction June 18. By the time of the annual meeting of the society in January it is believed that progress in the work will have been made, and it is thought that much will be accomplished at this meeting.

The committee consists of 28 members—seven appointed by the president and one chosen by each of the 22 local associations of members, with the exception of the Utah association, which has made no appointment. Onward Bates of Chicago is chairman of the committee. The other members are Paul G. Brown, Charles Hansel, Clifford M. Holland, Frederick C. Noble, H. R. Safford, S. Everett Tinkham, Richard L. Humphrey, J. C. Ralston, Robert A. Cummings, George R. Putnam, Baxter L. Brown, William H. Hoyt, George C. Mason, H. L. Haehl, George G. Anderson, E. B. Thomas, Edgar S. Nethercut, W. L. Darling, John L. Hall, Arthur Pew, J. H. Brillhart, Thomas L. Wilkinson, C. J. Tilden, F. T. Darrow, Arsène Perrilliat, George Butler and Gardner S. Williams. Photographs and short sketches of the lives of most of the members will be found in the news section of this issue.

President Talbot's Precept

An extended statement of his conception of the purpose, procedure and field of the committee is addressed to the committee by Prof. Arthur N. Talbot, president of the society. He first quotes the preamble and resolutions adopted last June, which were published in *Engineering News-Record* of June 27, p. 1200. Therein it was stated that "the development and application of the sciences in recent decades have caused profound changes in the social and industrial relationships of all peoples," and that "a broad survey of the functions and purposes of the American Society of Civil Engineers is needed in order that an intelligent and effective readjustment may be accomplished, so that the society may take its proper place in the larger sphere of influence and usefulness now open to the profession"; and it was resolved "that a committee be created to report on the purposes, field of work, scope of activity and usefulness, organization, and methods of work of the American Society of Civil Engineers, and to make recommendations concerning these matters. . . ."

President Talbot's interpretation of the action of the board of direction is as follows:

It is intended that the committee on development shall make a survey of the fields of usefulness which are or should be open to the society, consider what functions may properly be assumed by the society, define its purposes, formulate policies and methods of work to be recommended, and consider the needs in organization and constitution. This means taking stock and making plans. The resolutions contemplate an examination of present-day conditions and an outlook into the future. They involve considering the changing social and industrial relations of the times and the opportunities and responsibilities which devolve upon the society and its membership. The relations of the society to other societies and to the profession generally are also included. The outcome of the work of the committee may be modifications in the activities, functions and methods of work, or in the emphasis in these matters, and possibly the addition of new ones. Naturally, the resolutions assume that the views of the membership of the society will be asked for and its aid obtained in determining what the society's purpose and activities should be and how they may best be carried out. It is expected that the committee will report definite recommendations in the field of its work, and these recommendations may include proposals of fundamental changes which may involve amendment of the constitution of the society.

The Committee's Field

It would be premature to outline the ground to be covered in the committee's work; this may best be found by the committee as its work progresses. It may serve a good purpose, however, and aid in starting effective deliberations more promptly, if some expression is made of the possible content of the work. With this advantage in mind the following is suggested as representative of the field of the committee's work:

1. Relations of the society and its membership.

(a) The relations of the society to its membership and to the profession of engineering.

(b) The relations of the society to other engineering societies and to related organizations.

(c) The relations of the society, its membership and the members of the profession to public affairs, to the welfare of its members and the public, to the work of communities and nations and to movements of the times related to industry and society.

2. Organization of the society and the profession.

(a) The functions of the central organization of the society and its relation to other organizations.

(b) The functions of the local associations of members (including the membership at New York) and their relations to the society, to other societies and to groups of organizations.

(c) The organization of the engineering profession as a whole.

3. Technical activities of the society and its possible branch organizations.

(a) Meetings, papers, publications and committee work.

(b) Activities related to engineering progress and engineering problems.

(c) Sections or divisions of the society for specialized lines of work.

(d) Coöperation with specialized engineering societies and other organizations.

(e) Relations to other technical activities such as those of the proposed standards committee.

4. General activities of the society and its possible branch organizations and coöperative organizations.

(a) Activities related to public affairs and public welfare.

(b) Activities related to the welfare of its members.

(c) Relations to organizations dealing with industrial and Governmental problems.

5. Functions of the society in relation to the younger members of the profession and to those in executive, contracting and other lines.

6. Miscellaneous needs of the organization.

7. Proposals for changes which will involve making amendments to the constitution and formulating rules and methods of procedure.

Topics Interrelated

These general topics, which are mostly self-explanatory, are necessarily interrelated in a variety of ways. The subject of the relations of the society to its membership, the profession, the public, and the times involves questions of the purposes, functions and organization of the society. The organization topic relates to ways of managing activities and functioning with other organizations. The technical-activities topic embraces means for carrying on the technical functions of a great engineering society, contributing to engineering knowledge, creating or developing new engineering policies, originating and bringing about constructive, progressive movements, and developing engineering practice and engineering influence. The general-activities topic relates to the work of the society in connection with public affairs and the welfare of the profession and of society. The functions of the society with reference to the classes of members of the profession are bound up intimately with the topics already referred to. It will be noted that this outline of the field of work of the committee is not in the form of a program of work or order of procedure; the topics are too closely related to make it applicable to such uses.

Certain matters of policy which have been called to the attention of the board of direction have been referred to the committee, such as the rewriting of the code of ethics of the society, the suggested organization of American engineers abroad, and the question of what policy the society should take toward the adoption of standards, and doubtless other matters will be so referred. It seems probable that many members of the society will have proposals which they will desire to present.

Policies and Methods

The great questions before the committee, then, are (1) What are the functions which the American Society of Civil Engineers should assume? and (2) how should they be carried out?

It goes without saying that a society should consider and determine the functions it will undertake and the working policies it will pursue. In considering these matters, it is apparent that the formulation of a proposition is a step which may aid in judging of the value of the proposal, since the mere attempt at making the statement may bring out its impracticability or its undesirability. The formulation of propositions, too, takes the mind away from indefinite generalities and to definite proposals which should have much the same significance to all readers. It will be evident, too, that some proposals must be accepted only as principles or ideals and not as working rules, and a distinction between these two classes may well be made. Definiteness of statement of course is essential in a report of a committee such as this. Doubtless the committee will carefully consider functions and policies and their formulation.

Not less essential is the determination of the methods and ways of executing proposed functions and carrying out policies. In devising administrative plans it is well to keep in mind that organization should be left as simple and flexible as possible; elaborate or complicated organization and methods are likely to be ineffective; they are not self-propelling; and time makes changes in needs and scope of work.

In the course of its work the committee will doubtless find it desirable to consider whether changes should not be made in the constitution of the society, even though, as has been found true in the past, changes in methods and new activities may be put into effect without amending the constitution; the securing of the views of the membership of the districts on their choice for members of the nominating committee and the establishment of Engineering Council are examples of what has been done without modifications of the present constitution. It seems likely, however, that the committee will want to recommend ways in which the constitution should be changed. Here again it is suggested that simplicity, flexibility and breadth should be kept in mind, and that details be left for by-laws and regulations. It will be necessary to learn whether proposals for activities and methods come into conflict with the charter or conditions of incorporation of the society. Possibly the conditions governing the incorporation may limit somewhat activities which the committee may think desirable, and possibly the committee may conclude that modification in the articles of incorporation should be made or other steps be taken to give legal strength to their recommendations.

Coöperation With Committees of Other Societies

Proposals have been made that the other national engineering societies appoint committees to take up similar work for those societies. In case such committees are formed it will be the duty of the Committee on Development of the American Society of Civil Engineers to coöperate with these committees on subjects of common interest. The committee may also find it desirable to confer with representatives of local engineering societies over the country concerning the relations which the American Society of Civil Engineers and its local associations should bear to these local societies. It would appear that much may be accomplished through conferences with both national and local organizations.

Committee Procedure

The committee is so large and so widely distributed over the country that its work may best be done partly by correspondence and written discussion, partly through subcommittees, and partly at meetings of the whole committee. To insure that adequate progress be made at the first meeting of the committee, it is important that

preliminary work be done in advance of the meeting. This may well cover matters relating to the field of work, to the organization of the committee, and to proposals for the committee's consideration. At the first meeting, which will be called by the chairman, the organization and program of work may be completed and questions formulated on which it is desired to have preliminary discussions by the society. For the preliminary report requested for Nov. 1 the committee can hardly expect to do much more than record a program of work, propose questions on which the views of the membership are desired, and submit topics for discussion. Before the time of another meeting, which possibly may well be held at about the time of the annual meeting of the society in January next, progress in the work will have been made, and it may be expected that much will be accomplished at this second meeting.

In its work the committee will doubtless make a study of the engineering society organizations of this and other countries and of professional and scientific organizations of various kinds. Information concerning the society and its work may be obtained from the secretary.

The method adopted for selecting the committee gives a wide geographical distribution and an opportunity for the representation of local views. It has the advantages of giving a channel by which discussions of the problems at meetings of the local associations of members may reach the committee, and it is hoped that the local associations will be helpful in the work. It will be borne in mind, of course, that the committee is a committee of the whole society, and it is expected that it will give careful and impartial attention to the interests of every part of the society. The method of selection used should not be taken to mean that members of the committee are delegates of the local associations of members; and it also may be noted that the three geographical districts of the society which do not have local associations of members have much less than a proportionate representation on the committee. Necessarily proposals for new activities and for modification of old ones must take into consideration the financial resources of the society, and the financial side of all questions of course will receive the careful attention of the committee. The questions before the committee are the broad questions of policy, and personality will not enter into their discussion. With a variety of points of view and with the opportunity for widespread consideration of the proposals of the committee, it may be confidently expected that the final report of the committee will receive substantial approval from the society.

The committee has a great opportunity to be of service to the American Society of Civil Engineers and its membership. It is hoped and believed that the work of the committee will have significant and far-reaching results in the development of the society and the usefulness of the profession of engineering.

Should Treat All Sewage Going Into Boundary Waters

International Joint Commission Sets Tentative Standard for Safe Load on Water Filters—Recommends It Be Given Control Over Pollution

AFTER considering the pollution question for six years the International Joint Commission on Boundary Waters Between the United States and Canada has issued its final report on that subject. Its main conclusions are that the Great Lakes and other boundary waters are being polluted, in contravention of the treaty between the United States and Great Britain; that all sewage discharging into the boundary waters should be treated to some degree; that sewage entering the Detroit and Niagara Rivers should be so treated as to reduce to safe loading the burden on water-purification plants; that the treatment elsewhere should vary with local sanitary and economic conditions, having due regard to "the economic value of stream pollution" and to the public health; and that power to control the pollution of boundary waters should be given to the commission. As a tentative standard for the Detroit and Niagara Rivers the commission adopts the recommendation of its advisory engineers that the average load on water-purification plants should be kept down to about 500 B. coli per 100 c.c. as an annual average, or that B. coli should be absent in 50% of 0.1 c.c. samples. As a more ready standard, it is proposed that the stream receiving sewage should afford a dilution, or the sewage be diluted to give the equivalent of a dilution, of 4 cu.ft. per second per 1000 of sewage-contributing population. No attempt at even a tentative standard for other than the Detroit and Niagara Rivers is made by the commission.

The first report of the commission is dated Aug. 12, 1918. The report has not yet been printed, but extracts from it were presented at the convention of the American Society for Municipal Improvements on Oct. 3, in a paper by Capt. F. A. Dallyn, lately engineer of the Ontario Board of Health, and one of the engineering advisers to the commission. From Captain Dallyn's paper the conclusions and recommendations of the commission, seven in number, together with its discussion of the permissible limits of pollution and the standard of sewage treatment, all as given below, have been taken:

Seven Conclusions and Recommendations

1. The Great Lakes beyond their shore waters and their polluted areas at the mouths of the rivers which flow into them are, except so far as they are affected by vessel pollution, in a state of almost absolute purity. With the exception of these pure areas, the entire stretch of boundary waters, including the Rainy River, St. Mary's River, the St. Clair River, the Detroit River, the Niagara River, the St Lawrence River from Lake Ontario to Cornwall, and the St. John River from Grand Falls to Edmunston, N. B., is polluted to an extent which renders the water in its unpurified state unfit for

drinking purposes. This pollution has its origin chiefly in the sewage and storm flows from the riparian cities and towns, and the sewage from vessels. It is very intense along the shores of the Detroit and Niagara Rivers, and in the contaminated areas, in the lakes. Throughout the whole length of boundary waters, where sewage is discharged from the sewerage works of cities and towns, the pollution is almost all concentrated in the shore waters on the side of the boundary on which it originates. These shore waters, besides being in places unsightly, malodorous and absolutely unfit for domestic purposes, are a source of serious danger to summer residents, bathers and others who frequent the locality. So foul are they in many places that ordinances have been passed prohibiting bathing in them.

Health and Welfare of Both Countries Imperilled

2. In the Detroit and Niagara Rivers conditions exist which imperil the health and welfare of citizens of both countries, in direct contravention of the treaty. This is true, though in a less marked degree, of the Rainy and the St. John Rivers.

3. In St. Mary's, the St. Clair and the St. Lawrence Rivers pollution exists which is in substantial contravention of the spirit of the treaty, and unless these conditions are improved and the rivers placed under the control of competent authority, the resulting injury will be much more pronounced as population increases.

4. Vessel pollution in certain parts of boundary waters exists to an extent which causes substantial injury to health and property. It is derived from two sources, sewage waste from vessels and "water ballast" which is taken in by lake vessels at their ports of departure and emptied into those waters at or near their ports of destination. Vessel pollution is distinctly traceable in boundary waters in lakes and canals which vessels traverse in navigating them, their waters being thereby rendered unfit for drinking purposes.

5. In some cases sawmill and other mill wastes, garbage, offal, carcasses and other refuse matters are discharged into boundary water. This practice results generally in a contravention of the treaty.

Feasible to Prevent or Remedy Pollution

6. It is feasible and practicable, without imposing an unreasonable burden upon the offending communities, to prevent or remedy pollution, both in the case of boundary waters and waters crossing the boundary: (a) In the cases of city sewage, this can best be accomplished by the installation of suitable collecting and treatment works, the latter having special reference to the removal of bacteria and matters in suspension; (b) In the case of vessel sewage a feasible and inexpensive remedy lies in the employment of recognized methods of disinfection before it is discharged. In the case of water ballast suitable rules and regulations should be prescribed with a view of protecting the water intakes; (c) The discharge of garbage and sawmill waste into boundary waters should be prohibited, and industrial and other wastes, which are causing appreciable injury, should be discharged subject to such restrictions as may be prescribed.

(7) In order to remedy and prevent the pollution of boundary waters and to render these waters sanitary and suitable for domestic purposes and other uses, and to obtain adequate protection and development of all interests involved on both sides of the boundary, and to fulfill the obligations undertaken in article IV of the treaty, it is advisable to confer upon the International Joint Commission ample jurisdiction to regulate and prohibit this pollution of boundary waters and waters crossing the boundary.

Limits of Permissible Pollution and Standards of Sewage Purification

Two distinct lines of policy with regard to the disposition of sewage in boundary waters were suggested to the commission. (1) To look upon them as open sewers for the reception of riparian pollution of all kinds, and (2) to restore the purity of the boundary waters as far and as fast as a comprehensive and adequate appreciation of all interests involved will permit.

The first policy would not only be contrary to the treaty and the principles of international law, but the continued discharge of untreated sewage into boundary waters by either country would, especially in the cases of the Niagara and Detroit Rivers, be increasingly injurious to its own riparian communities farther down stream.

The advisory engineers in their résumé say:

"While realizing that in certain cases the discharge of crude sewage into boundary waters may be without danger, it is our judgment that effective sanitary administration requires the adoption of the general policy that no untreated sewage from cities or towns shall be discharged into the boundary waters.

"Water-supplies taken from streams and lakes into which the sewage of cities and towns is directly discharged are safe for use after purification, provided that the load upon the purifying mechanism is not too great and that a sufficient factor of safety is maintained; and, further, provided that the plant is properly operated.

Disposal by Dilution a Natural Resource

"In waterways where some pollution is inevitable and where the ratio of the volume of water to the volume of sewage is so large that no local nuisance can result, it is our judgment that the method of sewage disposal by dilution represents a natural resource, and that the utilization of this resource is justifiable for economic reasons, provided that an unreasonable burden or responsibility is not placed upon any water-purification plant and that no menace to the public health is occasioned thereby."

This "burden of responsibility" is a very important element to be considered in arriving at a standard of purification or the limits of permissible pollution. The advisory engineers were interrogated very fully on this subject at the New York conference and were pressed to define this limit in as exact terms as possible. Their answer is:

"While present information does not permit a definite limit of safe loading of a water-purification plant to be established, it is our judgment that this limit is exceeded if the annual average of B. coli in the water delivered to the plant is higher than about 500 per 100 c.c., or if in 0.1 c.c. samples of the water B. coli is found 50% of the time. With such a limit the number of

B. coli would be less than the figure given during a part of the year and would be exceeded during some periods."

It is scarcely necessary to remark that the engineers are speaking of bacterial pollution only. In view of the present stage of progress in sanitary science this limit or standard must be regarded as tentative. This evidence shows that they regarded the question as profoundly affected by conditions and in no sense capable of absolute generalization. The commission agrees with the statement of principles set forth in the four paragraphs quoted. It therefore recommends that *all sewage should before being discharged into boundary waters receive some purification treatment, the degree of such treatment to be determined in a large measure by the limits of safe loading of a water-purification plant.* [Italics ours.—Editor.]

To determine the extent of remedial treatment required in each particular case would involve consideration of the varied lines that have been followed by the commission throughout the present inquiry; the existence of pollution and of harm, actual or potential, to domestic or other uses, to public health or property; the results of the engineering studies of feasible remedies; and the economic facts relating to the conservation of stream resources. It would require the balancing of the value of remedial measures in the terms of public good against the cost of the requisite improvements.

On the one hand, it is evident that the paramount importance of public health and the binding obligations of the treaty must be borne in mind. These make impossible the recommendation of such lenient remedial measures as would work economic injustice or would indorse officially the continued spoliation of a natural resource to the injury of the citizens upon both sides of these waters.

Requirements Must not Be Excessive

On the other hand, sewage treatment requirements must not be made so excessive and unreasonable as to involve the cities and towns along these waters in an expenditure entirely unjustifiable. They should be reasonable and feasible from the standpoint of engineering construction or adaptability to local conditions, of the availability of necessary lands, of outfalls and incident structures, and of costs.

In view of the fact that pollution in the Detroit and Niagara Rivers, and its transboundary effects therein, are much greater than in the other boundary waters, these two rivers will be treated in one class, and the remaining boundary waters as another class.

The problem of necessary bacterial purification of the sewage discharged into the two former is one of extreme perplexity, owing to the difficulty or impossibility of obtaining definite and ample data and the relative importance to be attached to many of the factors which enter into it.

Safe Loading of Water-Purification Plants

After a great deal of consideration the commission has, in view of all the circumstances of the case, come to the conclusion that for the present, and as an immediate step in the way of restoration of the purity of these streams, the communities responsible for the discharge of raw sewage into them should purify it to such an extent that the resulting average cross-sectional pollution in each river will not exceed the limit of safe loading for a water-purification plant. In other words, the standard of purification required of these communities should be such that the streams after receiving their treated sewage would have a mean annual cross-sectional average of B. coli not exceeding 500 per 100 c.c. Compliance with the requirements of this standard would not impose upon the riparian communities along these rivers, discharging their sewage therein, a burden which would be unreasonable or greater than that ordinarily imposed upon urban communities which purify their sewage.

It necessarily follows that this standard of sewage purification, being based upon a tentative standard of safe loading of water-purification plants, must itself be tentative. The growing appreciation of sanitation, the consequent demand for a higher degree of purity in water supplies, and the constant improvement that is taking place in the processes of sewage treatment, tend to make a proper standard of sewage purification one of ever increasing stringency. The discovery of a new and much more economical, or possibly a profitable, method of disposal of sewage would naturally lead to the adoption of a stricter standard of permissible pollution in heavily polluted streams. Furthermore, any limit of permissible impurity that might be established even temporarily for a given stream must be influenced largely by strictly local considerations.

The data necessary for the formulation of a fixed standard either of sewage purification or of water purification are not sufficiently well established at the present time. By more precise methods of experimental study there will doubtless be obtained in the future a more ample and accurate command of facts which will admit of the determination of a more definite standard.

A Simple Working Standard

In view of the difficulties and uncertainties of bacteriological technique, it is distinctly advantageous to have, if possible, a working rule which is more accurate and readily determinable than the bacterial standard suggested. Professor Phelps, the consulting engineer, taking the results of the extensive investigations reported upon in the progress report as an index of the conditions actually existing, worked out such a rule or standard.

He found that if the sewage of the cities be diluted in a stream flow to 4 cu.ft. per second per capita of the population [per 1000 population?—Editor] the resulting water will contain approximately 500 B. coli per 100 c.c. If the dilution is proportionately less than this a corresponding degree of purification of the sewage will be necessary to maintain the final stream condition. Further investigations will no doubt make possible a more accurate statement of these relations, but, as the entire matter of standards is always subject to revision in the light of accumulated knowledge, it is considered that for all purposes of a present inquiry the practical equivalence of the dilution and the bacteriological standards may be accepted.

These standards are not applicable to rivers other than the Niagara and the Detroit, but it is in no sense

to be inferred, however, that remedial or protective measures are not required in their case where the dilution based upon the entire cross-section of the stream exceeds in every instance 4 ft. per second per capita [per 1000?—Editor] of the population.

As has been stated, the opinion of the board of advisory engineers is adopted that no untreated sewage should be discharged into boundary waters, but the commission considers it inadvisable at the present time to prescribe what the amount of treatment should be in the case of these remaining rivers. The sewage from each community along their banks must be considered by itself in respect of the degree of purification that is necessary, basing the standard on the reasonable use of the waters, the practical possibilities of remedial and protective measures, the economic value of stream purification, and also the economic value of stream pollution, proper regard being had to the public health.

After giving much attention to the question of standards of purification in these six boundary rivers the commission has come to the conclusion that the fixing of standards for them, and the subsequent modifications of these standards from time to time, should be left as recommended in the report to some authority clothed with the necessary power to deal with the question. This authority should also have power to vary, from time to time as conditions demand, the standards of sewage purification in the Detroit and Niagara Rivers.

Pavement Construction and Maintenance Considered

Abstracts of Papers Read Before the American Society for Municipal Improvements at Buffalo Last Week, Prefaced by Extracts from Presidential Address—Buffalo Reduces Cost of Street Cleaning by Adopting Motor Apparatus, Keeps Useful Asphalt Repair Records, and Improves Concrete Base by Scientific Sampling and Testing

Planning for Reconstruction Period

FROM PRESIDENTIAL ADDRESS BY N. S. SPRAGUE

Chief Engineer, Bureau of Construction, Pittsburgh, Penn.

DURING the early stages of the war some cities and towns, recognizing the importance of conserving man power and use of materials for such work only as is essential to the prosecution of national government purposes, reduced their program of municipal improvements to what was then considered the minimum. Now we all have come to a realization of the necessity for still further curtailment. The time has arrived when all municipal projects, nonessential to the winning of the war, or not needed for the preservation of the public health, must be deferred. The thousands of men thus released are needed in essential industry.

But what, may we ask, shall those of us who are retained in public positions find to do, outside of our regular official duties, to help our country? It occurs to me that the congestion on the railroads, emphasized by a more general use of highway thoroughfares for transportation of freight by motor trucks, points to work for some of us to do. An opportunity is here presented for highway engineers to study the effect of this motor truck traffic upon the various types of pavements now in use and to apply to their reconstruction the knowledge so acquired.

Public officials may also prepare plans for necessary municipal improvements, so that after the war is over work will be provided for the men returning home. This can be done by the reduced municipal engineering force. Neglected records of construction can be plotted and record plans completed. Pending the suspension of municipal improvement construction, there are, in addition to the foregoing, many ways to maintain and use to good advantage the municipal engineering staffs.

After the war will come the reconstruction period, and the American municipal engineer will, no doubt, be called upon to assist his European brothers in the gigantic task of rebuilding the cities and towns which have been destroyed. There is much which this society can do at present to help win the war, and the future offers even larger opportunities for work in our chosen profession.

Buffalo Reduces Cost of Street Cleaning by Use of Motor Apparatus

BY WILLIAM F. SCHWARTZ

Street Commissioner, Buffalo

MOTOR apparatus is being used by the City of Buffalo in its street cleaning department and has effected a saving. Sweeping, flushing and snow-removal equipment has been used, and a two months' demonstration in ash and garbage collection showed satisfactory results.

The city at the present time has two motor sweepers. These were bought and placed in operation Oct. 1, 1916, replacing six horse-drawn sweepers and two sprinkling wagons, and consist each of a combination sprinkler, sweeper and pick-up. They are each equipped with a 200-gal. tank, a large circular broom and a 1½-cu.yd. box. During the fiscal year which ended June 30, they cleaned approximately 72,000 great squares (a great square consisting of 10,000 sq.ft.). We found that they did the best work on smooth pavement, and that the cost per great square was about 2c. lower than in horse-swept districts; this in spite of the fact that there was considerable trouble in getting competent drivers and the machines did not work as satisfactorily as under normal conditions.

Three motor street-flushing equipments were installed during the past year to replace the old method of flushing and to do street cleaning in some districts. Each equipment consists of a 5-ton tractor with power take-off from the transmission to the pump that produces pressure for the flusher, and a trailer with a 2000-gal. tank capacity which sits upon the fifth wheel on the tractor. The trailer tanks have four nozzles which are controlled from the driver's seat, and the centrifugal pump, driven

from the power take-off, produces a pressure of 35 lb. at the nozzles. It is found that this pressure will not injure the pavement and at the same time does work cleanly. When the street is very dirty four nozzles are used which gush 525 gal. per minute, but, as a rule, only two nozzles, flowing 150 gal. per minute are used. Under the old system of flushing with portable line hose the cost per great square was $1.40. With the two-man reel, as used in New York City, we found the cost to be 56c., while with the motor equipment the cost was reduced to 20½c. per great square. This includes everything, such as operating labor, supervision and pick-up wagon.

Three additional flushers have been contracted for, and it is the intention of the department to do away, as soon as financial conditions warrant, with all horse-drawn sweepers and sprinklers and flush the entire city, with the exception of the cobblestone and macadam pavements. The cost per great square for sweeping was found to be 27.8c.; thus, flushing is not only economical but leaves the street in a more sanitary condition.

Snow removal is accomplished by removing the trailers from the tractors and equipping the tractors with snow-plows. It is estimated that during the past winter these three tractors saved the city at least $15,000 on snow-removal work alone. The cost of operation per 16-hour day, including operating charges, maintenance and fixed charges, was found to be $24.96. This was increased to $26.96 during the winter, on account of extra gasoline and oil used to run on low gear in bucking heavy snowdrifts.

For two months the department tested trailers and tractors in the ash and garbage division and found that it could cut the expense aproximately 25%, while getting greater efficiency. The system followed in the demonstration was to start empty trailers, drawn by horses, from the various barns to the different districts. When the trailers were loaded, the tractor with a train of four empty trailers would start picking up the loaded trailers and dropping of the empties, proceeding with the loads to the reduction plant. This operation was continued until a district was cleaned up.

Asphalt Repair Records Kept and Methods Followed at Buffalo

By C. E. P. Babcock and J. A. Vandewater

First Assistant Engineer

Assistant Engineer in Charge of Repairs, Buffalo, N. Y.

TABLES containing detailed cost records of pavement repairs have gone beyond the merely interesting stage and have become a necessity to the Department of Public Works of Buffalo, and are more referred to than any other tables, for this reason. They form a basis for argument and determination when there is a disagreement as to the advisability of expenditures on streets. During the 15 years up to June 30, 1917, about 3,000,000 sq.yd. of asphalt pavement were maintained annually, and detailed records were kept. Recently changes were made in the method of payment for repairs, which changes were made by the department after the data available were collected as to the thickness of the top and binder courses in repair work relative to the original construction.

With the expiration of guaranties on the first asphalt pavements and the assumption of repairs by the city out of its general funds, a detailed record was entered and carried on. From the printed report the cost of each street each year can be ascertained. As the life of asphalt pavements in Buffalo is (with few exceptions) 20 years or more, these records have assumed a considerable volume, and the question arose as to whether their value justified the space and the cost of printing them year after year. Fortunately, it was decided to continue the record, leaving off the early details and publishing the area and cost in detail for 10 or more years back.

These tables have been found a valuable basis for argument when the question arises, as it always does, as to whether a street has received an adequate repair or whether the city should continue repairing or should reconstruct the pavement. As two-thirds of the cost of repaving is assessed, of course the local desire is to postpone the local expense, regardless of the engineer's advice. Besides this, we locate and plot on cross-section paper every patch repaired, using different colors for each year. These plottings show not only the yearly repair, but, more important, where repair overlaps previous repair. The contractor guarantees his work for one year from Dec. 31 of the year in which it is executed; therefore, if a repair is made overlapping the joint of a repair under guaranty, an allowance of 6 in. is made and not charged to the new guaranty.

Repairs on Asphalt Pavements

The tabulations show that up to June 30, 1917, $2,899,781 has been expended on repairs for asphalt pavements, the average rate per square yard in area of the streets repaired being $0.0653, and on the area of streets maintained, $0.0451. The contract price has varied from 74c. to $1.39 per square yard laid up to Dec. 31, 1917, and, on account of labor and material conditions this year, the rate may run somewhat over $1.80 per square yard laid. Various curves have been plotted from the information collected showing the relation between the cost per square yard yer year and the age of the pavement in years. They were published in *Engineering News* of Sept. 26, 1912, p. 562. The present average age of all asphalt pavements under city maintenance is about 21.7 years.

Heretofore our contracts were made on the basis of a square yard repaired. For our resident asphalt contractors this seemed a fair basis, because they knew about the amount of the season's work and the material required for it. In 1908 investigation showed that of the original depth of asphalt, namely, 1½ in. of binder and 2 in. of wearing surface, about 52% depth of binder was used in repair, and about 82% of top. If an outside company wished to bid on the square-yard basis it would not have had this experience, and with our knowledge of the condition we felt that our contract should be made on something different from the square-yard measurement, thus eliminating the opportunity to manipulate to the contractor's advantage the lower priced binder and the higher priced top. Therefore, after collecting the data available, the Department of Public Works authorized new specifications, the principal factors in which are that both the top and binder be purchased at a price by

cubic measure delivered on the work; that asphaltic cement containing joints be paid for by the gallon delivered; that the cost of the street labor of chopping out patches, laying material and cleaning up be paid for by the square yard.

By this specification the city uses all of either the binder or the top, as its engineer requires, and pays for the amount actually used. The specifications quote for the information of the bidder, that the average depth experience for binder is 1.12 in., and for top is 1.57 in., or 75 and 78% of the original depth. For 1917 work the percentages were 58 and 78, respectively. The reduction in binder is partly due to the fact that our pavements are becoming thin. When the old pavement is less than 2 in. deep the specifications provide that no binder shall be used for repair.

Bids are received and inspection of all pavements are made early in the year, the endeavor being to repair all asphalt pavements at least once a year, and when necessary, where traffic is unusually heavy, twice a year.

Work is begun about Apr. 1, and usually continues until about Dec. 1. Pavements to be repaired are marked out by what we term an "asphalt locator," who marks the patches to be repaired, measures them and makes a complete record. The contractor also makes a record which must correspond with that made by the city's locator. The repair gang then follows, chopping out, relaying the new material and cleaning up. A gang of 75 or 100 men will lay from 750 to 1000 sq.yd. per day, depending on the sizes of the patches.

Concrete Base Improved by Scientific Sampling and Testing

By George F. Fisk

Resident Engineer in Charge of Pavement Construction, Buffalo, N. Y.

Installation of complete sampling and testing methods by the bureau of engineering, Department of Public Works, Buffalo, N. Y., has resulted in great improvement in the quality of concrete base produced by paving contractors. Accurate proportioning is obtained, both by studying materials according to the measuring method of determining voids, and by a comparison of specially plotted logarithmic curves with Fuller's curve plotted to the logarithmic scale. Examination of the results obtained in many tests, while not conclusive, tends to show that local gravel concrete is equal to crushed stone concrete, that aggregate obtained by breaking up and screening old concrete bases is acceptable, and that the amount of water used has a direct relation to the compressive strength of the concrete obtained. It is also shown that the use of stone screenings for sand has a detrimental effect.

Buffalo is fortunate in being able to obtain a gravel which is nearly ideal for making concrete. It is obtained from sedimentation banks in the Niagara River, near Strawberry and Squaw Islands, and was delivered in South Buffalo last year at a cost of $1.55 per cubic yard. Another supply of gravel known as Buffalo Creek gravel is taken from the banks along the creek. While the Niagara supply is very clean, with scarcely a trace of organic matter, the Buffalo Creek supply is unreliable in respect of evenness of run and cleanness. In the same bank may be found a clean gravel and a gravel carrying loam running as high as 15%. It also contains considerable débris and shale. It can be delivered at a cost of $1.25 per yard, and contractors desired to use it in their concrete.

These conditions led the city to purchase a 200,000-lb.

LABORATORY REPORT (PRELIMINARY)

DATE.....

.....STREET, between..... and .....

Stone from
Gravel from

Grit from
Sand from

		Lbs.	Lbs %	Tot %
	Passing 2½" mesh			
	Held on 2" "			
	" 1¼" "			
	" 1½" "			
	" 1¼" "			
	" 1" "			
	" ¾" "			
	" ½" "			
	" ⅜" "			
	" 6 "			
	" 8 "			
	" 10 "			
(Sand)	" 20 "			
	" 30 "			
	" 40 "			
	" 50 "			
	" 60 "			
	" 80 "			
	" 100 "			
	" 200 "			
	Passing 200 "			

Sand passing No. 10 Mesh
Wt. of 6x6x6 cube full Lbs.
Wt. of 6x6x6 cube empty Lbs.
% Voids Net Lbs.

10 Lbs. grit as delivered.
Held on No. 10 Mesh Lbs.
Passing No. 10 Mesh Lbs.

1000 Grams sand—Pass No. 10 Mesh

	LBS. %	TOTAL %
Held on 20 Mesh		
" 30 "		
" 40 "		
" 50 "		
" 60 "		
" 80 "		
" 100 "		
" 200 "		
Passing 200 "		

Stone
Gravel held on No. 10 Mesh
Wt. of box full (½ C. Ft.)
Shaken Lbs.
Wt. of box (½ C.Ft.)empty Lbs.
% Voids Net Lbs.

FIG. 1. PRELIMINARY LABORATORY REPORT ON COARSE AND FINE AGGREGATE

hydraulic testing machine to ascertain whether concrete made with Buffalo Creek gravel was satisfactory as a permanent pavement foundation. Contractors were informed of this purpose, and not one of them has made a request to use Buffalo Creek gravel since the machine was installed.

Sampling starts as soon as the material is delivered on the job, the assistant at the laboratory is notified and he obtains samples of the gravel or stone and the sand and cement. He makes his screen analysis and delivers a preliminary report the same day to the engineer in charge of the work. The form for this report is reproduced herewith. The screen analysis is made by means of a sieving machine, while the voids in the material are measured by the amount of water which can be held by a certain cubical content. A 6-in. cube is used to obtain the voids in material passing the No. 10 mesh, this size having been found as accurate as a cubic-foot box and much easier to handle.

For testing unsifted gravel a 1-cu.ft. box is used. The gravel is put in the box, a small amount being thrown at a time, water being added and tamping done lightly. When the box is full, the measured cubic content of water indicates the voids which should be filled with cement.

It is thought that this analysis forms a fair comparison for proportioning where the gravel is used as it comes, but if the sizes of coarse and fine aggregate are not in proportion, in either case it means the requirement of an excess of cement in the mass. For

this reason, a screen analysis of all material is made.

By referring to the cut, Fig. 1, it will be seen that the dividing line between fine and coarse aggregate is placed at the 10 mesh. Making the division at the ¼-in. mesh leaves that portion held on the 6 and 8 mesh to be included in the fine aggregate, and it may be that the cement proportioned 1:3 for the fine aggregate passing the ¼-in. mesh may not be sufficient for that portion held on the 6 and 8 mesh.

Upon receipt of the preliminary report, and before concreting begins, the engineer in charge figures the

MATERIALS IN CONCRETE BASE

STREET from to

CEMENT manufactured at

Screen Analysis No.					Tensile Strength	
	Mesh	Grams	Per Cent	Per Cent Cumulative Weight	Average of (5) five briquettes	
					Neat	1:3 Ottawa Sand
All passes	40					
Retained on	50				24 hrs. = lbs.	
"	100				7 days = "	7 days = lbs.
"	200				28 days = "	28 days = "
Passing	200					

SAND from

Screen Analysis No.				
	Mesh	Grams	Per Cent	Per Cent Cumulative Weight
All passes	10			
Retained on	20			
"	30			
"	40			
"	50			
"	60			
"	80			
"	100			
"	200			
Passing	200			

Tensile Strength

Av. of (5) briquettes 1:3 cement

7 days = lbs.; 28 days = lbs.

Absolute Volume (below No. 10 Mesh)

Dry Weight 6" x 6" x 6" cube = lbs.

Vol. per cu. ft. = ×4.83 =

CONCRETE (Mixed on Street)

Mix: bags (94 lbs.) cement: cu. ft. sand: cu. ft. stone cu. ft. gravel

Q = 2.61 ÷ 0.723 x cu. ft. sand + 1.08 x cu. ft. stone =

Total No. bags cement necessary =

Total No. bags cement used =

Compressive Strength

6" x 16" cylinders stored in H_2O

	lbs. total =	lbs. per sq. in.
7 days =		
10 days =	" " =	" " " =
28 days =	" " =	" " " =

STONE from
GRAVEL "

Screen Analysis No.				
	Mesh	Lbs.	Per Cent	Per Cent Cumulative Weight
All passes	2½"			
Retained on	2 "			
"	1½"			
"	1¼"			
"	1"			
"	¾"			
"	½"			
"	⅜"			
"	6			
"	8			
"	10			
(Sand)				
"	20			
"	30			
"	40			
"	50			
"	60			
"	80			
"	100			
"	200			
Passing	200			

Absolute Vol. (above No. 10 Mesh)

Cu. ft., Dry Weight = lbs.

Vol. per cu. ft. = ×.604 =

Signature of Tester Date 191

Note.—Show all computations on back of this sheet. Serial No.

FIG. 2. FORM OF REPORT ON CONCRETE AND CONCRETE MATERIAL. FORM SIZE 8½ x 13¾ INCHES

proportions necessary to make a concrete of maximum density. The voids are determined by weight, the specific gravity of the sand and gravel being taken at about 2.65. If the sand appears dirty the colorimetric test is used for organic material.

After the proportion to be used is tentatively decided on, a logarithmic analysis curve is plotted representing the per cent. passing the different screens. This was first done because it was found that a clear idea of the gradings below the 40 mesh could not be obtained by using a standard screen scale. In the chart plotted the abscissas are the logarithms of the mesh opening in inches, while the ordinates are the logarithms of the per cent. passing the mesh by weight. Fuller's curve of the parabolic form plots on this chart as a straight line, and the fine gradings are shown in a very distinct manner.

This curve shows how the mix may be improved, using Fuller's curve of maximum density as a standard. The analysis curves of the local gravel have invariably shown that below the 60 mesh the gravel is deficient in fine material from 1 to 6%, and between the 1 mesh and the maximum size the gravel is often deficient in coarse material between 5 and 15%. Between the 60 mesh and the 1-in. the curve will follow very closely the standard curve of maximum density. From a practical standpoint, it is easy to add a small amount of coarse aggregate, but adding from 1 to 6% of material passing the 60 mesh is difficult, and for paving work is not economical. In any event, the compressive tests have shown that the cement probably makes up for the deficiency, as 87% of the gravel concrete and 96% of the stone concrete of 1:2:4 mix have shown a test of 2000 lb. per square inch in compression at 28 days. The specific gravity of this concrete was about 2.366, as determined by numerous tests.

How Concrete Is Sampled

Sampling of the concrete as actually laid in the street is done as soon as the concrete gang has the work well started. The laboratory assistant, who has been notified, makes up his samples, five in all, in cylinders 8 in. in diameter and 16 in. long, one cylinder being filled for every 25 or 30 ft. lengthwise of the street. In filling the cylinder, one-fourth of its cubic content is taken from each of four batches, to get a better average of the mix. The cylinders are left on the street where made for 24 hours, then they are stored in water and tested at 7 days, 10 days and 28 days, three being averaged for the 28-day result. The inspector each day sends in a report of the number of square yards of concrete laid and the number of bags of cement used, and all these tests and data are entered upon the form as shown in the cut, Fig. 2, where the results obtained can be readily compared with the theoretical amounts which have been previously figured. When the data for the street are complete, the report is filed for future reference.

Throughout the tests, the results have shown that there is a direct relation between the compressive strength of the concrete and the amount of water used; in fact, the greatest variation in strength can be traced to the different amounts of water used. This does not mean, however, that the strength of the concrete is dependent solely upon the materials used, for the best materials with careless workmanship, such as inefficient mixing, will give concrete of low compressive strength. On the other hand, with an inferior material, but with scientific proportioning and a proper amount of water and mixing, good results may be obtained.

The tests further indicate that the old natural-cement foundations can be broken up and screened and the old stone used as a coarse aggregate for new concrete base, with excellent results. Tests on samples taken from concrete using this coarse aggregate showed an average of 1729 lb. per square inch for the 28-day test. It is also shown that broken limestone or broken sandstone paving blocks, using stone-sand, do not make a satisfactory concrete unless a greater proportion of cement than 1:3 is used. Better work is obtained where Niagara River grit is used with the crushed stone. This is because the stone-sand carries too much fine material between the 100 and 200 mesh to mix properly with the cement.

Recent Erie Flood Similar to Inundation of 1915

Though of Greater Intensity, 1918 Storm Was of Shorter Duration—Flood Prevention Structures Helped

BY FARLEY GANNETT
Harrisburg, Penn.

MILL CREEK, at Erie, Penn., rose in flood on Monday, July 29, 1918, the result of a heavy rain in many ways similar to the rain which caused the great flood of Aug. 3, 1915. The recent flood, however, did little damage, whereas that of three years ago killed 35 persons, destroyed $2,000,000 worth of property and tied up traffic and business throughout the city for several days. A comparison of the two storms and their results is interesting.

The two storms started at nearly the same hour of the day and on nearly the same day of the year, and by reason of these facts the storm of 1918 caused consternation in the city. With the memory of the previous flood in mind, the citizens lined the banks of the creek for hours, watching the flood. The creek kept within its banks except for one point where a building spans the stream and restricts the channel. Here the water was diverted and flowed down French St. some 6 in. deep, filling cellars and stopping traffic.

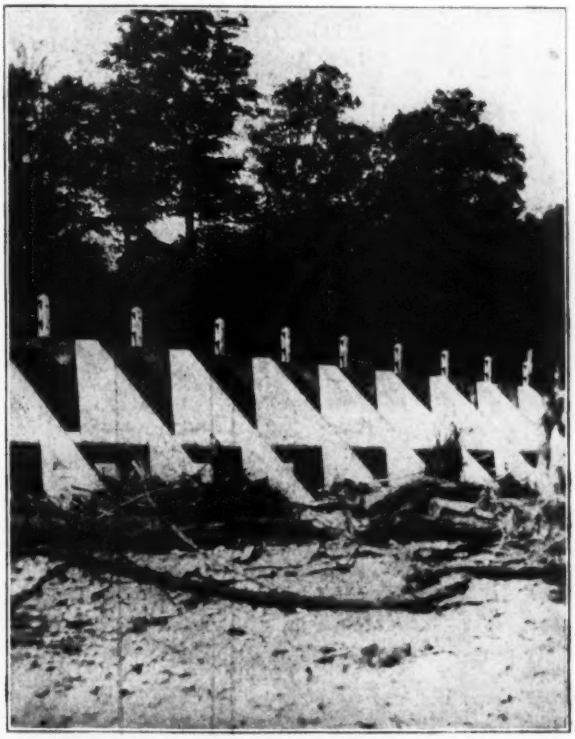
After the flood of August, 1915, works were designed by the writer's firm, and the construction of these works has been under way for about a year. A drift catcher, consisting of a structure resembling an Ambursen dam without a deck, was constructed about ½ mile above the city, and a reinforced-concrete conduit 22 x 18 ft. inside dimensions, about 2½ miles long, is being built through the city to carry the creek.

The storm of 1915 came in three waves, while that of 1918, fortunately, was in only one. The storm, however, was similar to that of 1915, and of even greater intensity at times, as shown by Table I.

The 1915 storm gave 4.27 in. in three hours, while that of 1918 in two hours gave 2.60 in. of rain. For the two hours of greatest intensity in 1915 the precipitation was 2.89, or only 0.29 in. more than that of 1918. Table II shows the periods of greatest intensity for both storms and strongly indicates their similarity.

In 1915 the rain started at 3:30 p.m. and the crest of the flood occurred at 9:30, the rain continuing with few letups until 7:30 and beginning again about 9:30. In 1918 the rain began ½ hour later and the crest occurred at 7:30, ½ hour after the rain stopped. The drainage area is practically 11 square miles.

The precipitation during the first hour of the recent storm was greater than that during the first hour of that of 1915, 2.07 in. falling during the first ½ hour



DRIFT CATCHER BUILT AT ERIE AFTER 1915 FLOOD WORKS IN 1918 FLOOD

as against 1.5 in. in 1915, and 2.75 in. up to the end of the second hour, as against 2.84 in. in 1915. The 1915 storm continued so violently after the second hour that 4½ in. had fallen at the end of three hours. The 1918 storm was practically over at the end of one hour, whereas after three hours of rain in 1915 another violent storm descended, making altogether 5.77 in. of rain falling between 3:30 p.m. and 5:30 the next morning. Over the watershed above the city the rain in 1915 was even heavier than in the city at the Weather Bureau gage. At some points indications and fairly good evidence pointed to a total maximum rainfall of about 9 in. during the afternoon and night.

The flow of the creek at the peak of the flood of 1918 was not measured, but estimates were made indicating that the discharge was at the rate of 5000 cu.ft. per second, or 450 sec.-ft. per square mile of watershed, as against approximately twice as much in 1915.

Several factors are responsible for the much less serious results of the 1918 flood. In the first place, the

TABLE I. RAINFALL IN TWO STORMS

Storm of Aug. 3, 1915		Storm of July 29, 1918	
Time of Day	Rainfall, In.	Time of Day	Rainfall, In.
3:30–3:45	0.12	3:57–4:12	0.63
3:45–4:00	0.19	4:12–4:27	0.92
4:00–4:15	0.40	4:27–4:42	0.28
4:15–4:30	0.51	4:42–4:57	0.40
4:30–4:45	0.16	4:57–5.02	0.26
4:45–5:00	0.07	5:02–5:07	0.11
5:00–5:15	0.12	.....	.....
5:15–5:30	0.64	.....	.....
5:30–5:45	0.40	.....	.....
5:45–6:00	0.22	.....	.....
6:00–6.15	0.03	.....	.....
6:15–6:30	0.16	.....	.....
6:30–6:45	0.74	.....	.....
6:45–7:00	0.51	.....	.....
Accumulation.....	4.27		2.60

TABLE II. PERIODS OF GREATEST INTENSITY

	1915	1918
5 min.....	0.39 in. rate 4.68 in. per hr.	0.38 in. rate 4.56 in. per hr.
10 min.....	0.66 in. rate 3.96 in. per hr.	0.65 in. rate 3.90 in. per hr.
15 min.....	0.87 in. rate 3.48 in. per hr.	0.94 in. rate 3.76 in. per hr.
30 min.....	1.38 in. rate 2.76 in. per hr.	1.55 in. rate 3.10 in. per hr.
1 hr.....	1.50 in. rate 1.50 in. per hr.	2.07 in. rate 2.07 in. per hr.
2 hr.....	2.84 in. rate 1.42 in. per hr.	2.62 in. rate 1.31 in. per hr.

storm came in a single period of about one hour. The soil was dry from a long period of comparative drought, so that the first part of the precipitation was absorbed and did not contribute to the flood crest. An important factor, also, was the drift catcher, mentioned above, which caught débris from the upper watershed and prevented the blocking of culverts and bridges as in 1915. This structure, illustrated, was described in *Engineering News-Record* of Oct. 25, 1917, p. 793.

Even with the comparatively favorable conditions, business was upset to a certain extent, street-car traffic from east to west across the city was tied up, and this flood, serious enough in itself, although far less so than that of 1915, illustrates well the necessity for the flood-control projects under way.

The contractor now on the work is the Alskogg-Folwell Co., Chicago, who succeeded the original contractors. Their bid is on the basis of unit prices and on these prices the work will cost at least 50% more than at the prices in the original contract. The first contract was let in December, 1916, and the new contract in July, 1918. The engineers who made the preliminary report and detailed designs and are now supervising construction are Gannett, Seelye & Fleming, of Harrisburg and Erie, Penn.

Valuation of the Railroads—Is It Worth While?

Likely to Cost $50,000,000 More Without Helping Win the War—Should Be Discontinued, at Least Until the War Ends

BY A FORMER GENERAL MANAGER

ABOUT four years ago the work of valuing the railways of the United States was begun under the direction of the Interstate Commerce Commission, and to date not a single line of railway has had its valuation completed, in the sense that the valuation has been subjected to the final test required by law.

At the recent hearing before a committee of Congress the director of valuation requested an appropriation of $3,750,000 for the fiscal year ending June 30, 1919. There has been expended to date $12,800,000, which, with the appropriation requested, will make a total of $16,550,000 appropriated for this work to June 30, 1919. The director estimated that the field work would be completed by Jan. 1, 1920, and the office work by Jan. 1, 1921, and that the total cost of work would not exceed $20,000,000. The director stated at the hearing that at the beginning selection was made of a small road in Texas, the Texas Midland, 111 miles in length, in the expectation that in about six months the valuation on this line would be completed and sent to Congress as a specimen of the valuation work. The result has been that the valuation on this small railroad has not yet passed through the various processes required by the act, the most important of which is the final determination of the matter in the courts.

The making of the physical valuation by the commission, and the filing of a tentative valuation, is only a part of what the final valuation will be. The carrier has a right to protest, has in every case so far protested and will in the future cases protest, so that before the final legal valuation is determined it will drag its weary way through the courts. It is safe to assume that even if appropriations are made by Congress to carry on the work of the commission to the presenting of tentative valuations, this work alone will not be completed short of five more years, or about Jan. 1, 1924. After that the valuation of each separate road will pass through the courts, and if the litigation is followed as diligently as it has been by the commission it will require ten more years to establish the final valuations in court, which will place the date about 1934 before we shall know finally what is the valuation of our railroads.

$20,000,000 OR $50,000,000?

The cost, estimated by the director of valuation at $20,000,000 for the completed work, has been estimated by competent engineers as likely to reach $50,000,000 before the final results are secured. The railways are, independently in many instances, making complete valuations, largely duplicating the work of the commission and the cost of the work. The cost of litigation to determine the value finally will add enormously to the expense, so that the estimate of $50,000,000 and 20 years' time to settle this matter may not be excessive.

The question as to the real value of this work has been argued pro and con for years. That it has some value is evident, but that value lies chiefly for purposes such as taxation, entirely outside of the original intention of the commission, which was to determine the matter of reasonable rates of transportation.

The establishing of rates is such a complicated problem and involves so many elements entirely distinct from the value of the property that it would be impossible to make any use whatever of this information as a guide in establishing rates. For illustration, the cost of operation of a property forms one of the elements in the cost of the service, aside from the cost of the use of the property, which is the only element which the value of the property can affect, so that only a very small part of the problem of rates is known where the value of the property is known. Again, what applies to one property will not apply to another, and it would be impossible to establish a system of rates, based on one line or a number of lines, which would be applicable to all alike.

If the object of the commission is to ascertain the value for the purpose of Government ownership, then the valuations which the commission is determining are incomplete, as many important elements have not been established nor taken into account—elements which the carriers will seek to have determined by the courts.

If, then, the valuation is only a partial one, and consists mainly of the physical property, which can be determined in almost every instance from the existing records of the railways, what purposes can be accomplished in continuing a work of such doubtful value, and at this particular time when every ounce of energy should be devoted to winning the war? The Government itself has enjoined every one to dispense with all unnecessary or nonessential work and expense during the war. If there is any activity that falls within this class it is the valuation of the railways, which nearly every practical railway and business man has long ago concluded was of no definite value for the purpose for which it was designed.

The director of valuation recommends not only the continuance of the work but an additional staff to follow up the cost of additions and betterments from Jan. 1, 1918, and during Federal control of the railways. This will be a duplication of work, as the operating staffs of railways under Federal control are now Government employees, and the carriers are specifically charged to perform this work. What is the necessity of having this same work done by the bureau of valuation? It will be an unnecessary waste of money and of man power.

Resumption Possible After the War

Discontinuance of the work during the war will not prevent its resumption after the war if it should be shown to be of value or necessary. The additions and betterments made during Federal control of the roads will be accurately determined, and the work of obtaining the physical units will not be affected by a suspension for the duration of the war.

A small office staff of men not available for war duty could be assigned for working up the field data, which are already a year behind the field work, so that at the end of Federal control the valuation work would be in better shape than it is at the present time. But if the work is continued after the war it should be done along common-sense lines, and much of the present system, which goes with refinements not warranted to secure the essential results, should be eliminated. If this is done the work can be shortened about one-third, thereby decreasing the cost and hastening its completion. As a matter of fact, with few exceptions the physical value of almost any railway is as definitely known by the records of the respective roads as can be determined by the methods possessed by the commission. The physical value is only one element in the whole problem, to which must be added the intangible values which will be recognized and determined by the courts.

We are passing through rapid economic changes, and no one knows what the public policy will be toward the railway problem during the reconstruction period following the war. One thing is looming up large on the horizon, brought about by Federal operation of the roads during the war; this is that the private owners of the railroads would welcome the taking over of the title to the property, thus relieving the owners of the present uncertainty as to its value after the war.

The English policy toward the owners of railways is totally different from that followed in the United States. In England the integrity of the roads under various ownerships is being maintained, and full payment is being made for their use by the Government during the war. The English stockholders are not on the anxious seat as to what will become of their property, the Government realizing full well its obligation to the owners and what the effect upon the financial stability would be if any course were taken that would affect the financial status of railroad property. This is certainly a wise and conservative policy, and lies at the fundamental principles of English financial history—principles that have placed England in her position of strength as a financial world power.

The railway problem in the United States is the coming large problem and must be carefully handled to prevent a financial disaster to this country.

Heavy Rainfall Tests Mill Creek Sewer at St. Louis

Relief Sewer Pressure Tunnel Comes Into Full Play —Automatic Water-Level Recording Gages Found Useful

By W. W. Horner
Engineer Design and Construction, Sewers and Paving, St. Louis, Mo.

THE extraordinary downpour which occurred in St. Louis on Aug. 24, described on p. 672, offered the first actual test of the flow through the Mill Creek sewer relief tunnel, completed two years ago. A full description of the design of this tunnel appeared in *Engineering Record* of Oct. 10, 1914, p. 405. The relief tunnel is a second main sewer for the Mill Creek valley, the total drainage area of which is about 5000 acres. The original main sewer had a maximum capacity of about 3500 sec.-ft., and the critical time was about 52 min. In designing the relief tunnel the engineers intended to provide through it an additional main sewer capacity of about 3300 sec.-ft., or a total capacity for the two sewers of 6800 sec.-ft. This represents a run-off coefficient of about 1.35 cu.ft. per second per acre, as compared with an estimated rainfall, for which it was economical to provide, of a 2.2-in. rate for the 52-min. period. This latter rate lies on a rainfall curve the ordinates of which had at that time not been exceeded more than once in the life of the recording stations.

Sewer Tunnel Under Pressure

Upon completion of the tunnel four automatic water-level recording gages were installed. These gages consisted of one pair about ½ mile apart in the lower section of the sewer and another pair about the same distance apart near its upper end. On account of the operation of the sewer as a pressure tunnel very high ranges were required, the extreme western gage having a range of 50 ft. The tunnel operates as an overflow from the existing surface system and only comes into play during rains of moderate intensity. For that reason very few records have been obtained since the installation of the gages, and these of only very small amounts.

During the excessive rain of Aug. 24, however, the old main sewer was running under head, the manhole covers being blown off throughout most of its length. It undoubtedly carried considerably more than its rated capacity. At this time the tunnel came into full play, the recording gages indicating the hydraulic gradient very close to that for which it was designed. The two lines are remarkably close, the most radical difference being at the outlet, where an observer reports that the sewer did not run full at the mouth. This was evidently due to the low water in the Mississippi and to the establishment of a backwater curve in the sewer. It also seems to indicate that the roughness coefficient throughout the lower 2000 ft. of the sewer was greater than was anticipated. This may be due to the fact that this particular section was constructed in cut and cover through quicksand, while the remainder was in tunnel through rock.

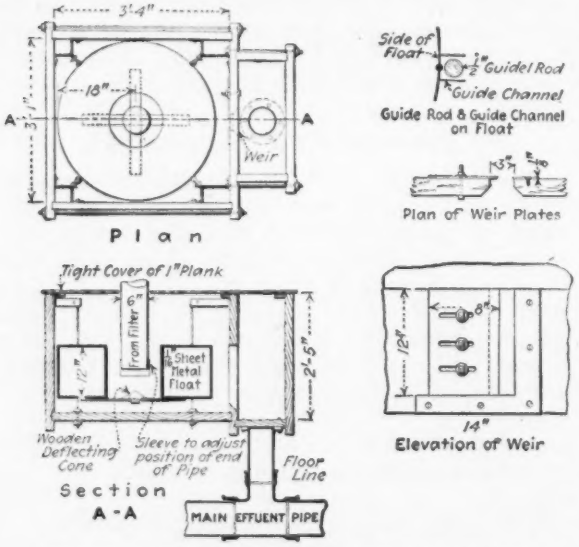
Because of the fact that even the old and the new

sewers combined failed to offer sufficient outlet capacity for this system, any accurate estimate of the rate of run-off would be futile. The run-off certainly far exceeded the capacity of the two sewers, which was 6800 sec-ft. It was probably double this amount, or say 13,600 sec.ft., or a rate of 2.7 cu.ft. per second per acre compared with a probable average rainfall rate throughout the 52-min. period of 3.4 inches.

Build Filters for Fighters in France From Odds and Ends

Greatest Difficulties Are Uncertainty of Delivery and Scarcity of Supplies—Design Layouts to Fit Four Types of Filters

FOR the construction of a filtered water-supply of 700,000 gal. for a French village crowded with American troops, France had to be combed from one end to the other to obtain the necessary pipes and pumps. But the filters gave the greatest difficulty, writes an engineer who knows. Four kinds of filters were possible, and the layouts had to be made so that accessory piping would fit whichever type finally should prove available. Improvised rate controllers, float valves from globe



FILTER RATE CONTROLLERS ARE HOME-MADE

valves, and reinforcing rods of iron and steel scraps welded together, were some of the expedients used.

Most of the water projects are relatively simple and involve little that is novel. Water is generally easy to obtain in sufficient quantity from springs or shallow wells, but sometimes stream water must be used. Tubular wells are rare and usually of small yield. Labor is scarce and material hard to obtain. Then there is the virtual impossibility of getting all the material and all the labor on the job at the same time. These difficulties are an inevitable part of war, because if all the material and all the men wanted were available the enemy would not last long. The material and labor situation has more and more forced the use of simplified installations. The 50-gal. allowance for the cantonments in the United States has been cut to 10-gal. in France. It has been found that one of the best ways to stimulate economy of water is to make it somewhat difficult to obtain, and that in turn simplifies the waterworks construction.

At first it was expected that made-up filters of the wooden tub type would be received from America. Then it looked as though mechanical or drifting sand filters could be obtained from England. Later it appeared that it would be unwise to count upon receiving either the English or American filters, and that a special design utilizing wooden tubs would be more desirable, and still later it became evident that the delivery of wooden tubs could not be definitely relied upon and that reinforced concrete might have to be used. After tentative layouts had been made for each one of these types as a basis for ordering connecting piping, valves, specials and other accessories not furnished with the filters, the continued uncertainty of what kind would finally be available, together with the urgency of placing orders for connecting piping, valves, specials and accessories to insure timely fabrication, preparation and delivery, made it necessary to prepare plans for the four types of mechanical filters so coördinated that the same accessory material could be used for any one of them.

It was the intention to place orders at once for all the material common to all the layouts, and locate material suitable for filter equipment, should it be necessary to employ the special designs for either wood or concrete. Just as necessary plans and lists of materials were completed it became evident that made-up filters of any type would be unobtainable; also that wooden tanks could not be procured. This left the coast clear for the installation of a specially designed concrete layout as the only remaining practicable scheme.

The gathering of the miscellaneous material required for the filters as well as other parts of the project was no easy matter. Only certain standard pipes and fittings were available through normal supply channels, and it became necessary, to obtain what was needed, to visit by means of automobile or motorcycle side car nearly all the foundries, machine shops and supply houses in this section of France.

"That has all been done now [our correspondent's letter is dated Aug. 16.—Editor] and the work is nearing completion. The final layout will be neat and effective, but I do not believe there was ever a filter plant built in the United States of ten times the size that required so much designing or embodied such a choice assortment of odds and ends of material."

One of the interesting little problems was to obtain a satisfactory filter sand from a rather dirty and nonuniform river sand, the only sand available. This was accomplished by drying the sand, double-screening it in a single operation to exclude that which was too fine and that which was too coarse, and finally by washing to remove fine particles of clay and silt that were not removed by screening. The sand could have been completely graded by water action, but this would have required more water than could be spared during the unusually dry season and also larger and more elaborate apparatus.

A rate controller had to be designed involving no machine work and using up a minimum of head. The apparatus shown in the drawing behaved steadily and

apparently reliably under preliminary tests. The inlet pipe to the apparatus is carried below the water level in the center of the doughnut-shaped float. The float carries a properly supported wooden cone which, rising against the end of the inlet pipe, constitutes the cut-off valve. The rate of flow through the apparatus is controlled by a short crested weir with a relatively high head. The total head lost in the apparatus is the head on the weir, or about 8 in. under normal conditions. The water in the clear-water basin may rise to within practically this distance of the water level maintained in the controllers, before the rate of filtration is cut down. The loss of head may be made still less by lengthening the crest of the adjustable weir, but this tends to decrease the accuracy of the apparatus.

A float-controlled inlet valve into the coagulating basin was necessary to maintain the water level constant both in the basin and in the filters. A suitable commercial valve could not be found anywhere, but with very simple modifications of a 6-in. globe valve a very good balanced float valve was obtained.

For reinforcement for the concrete practically all the iron and steel rods available in a nearby city were purchased. They were of various lengths, sizes, cross-sections and strengths, but by welding, piecing and adjusting there was obtained the virtual equivalent of the reinforcement computed as being necessary.

Plant Prepares Slag for Roads and Concrete

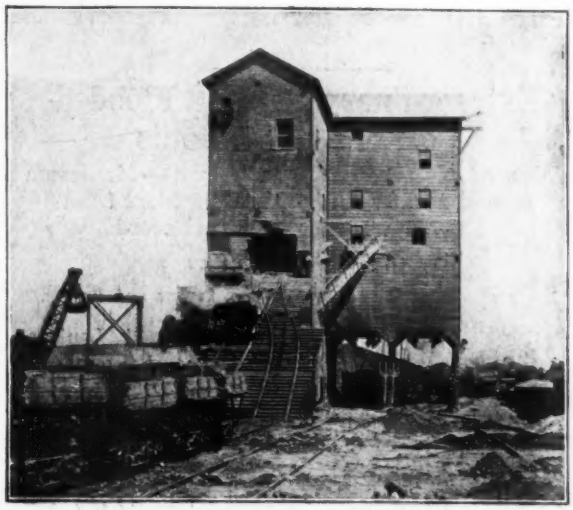
Material Combines Strength With Light Weight—Crushing, Screening and Iron Removal Form Principal Treatment

PREPARATION of blast-furnace slag for road construction, track ballast and concrete work, at a plant in South Chicago, Ill., is in general similar to the preparation of broken stone, the material being crushed and screened, but special provision is made for cooling the hot slag and recovering particles of iron. This plant supplies slag for territory within a radius of about 100 miles, beyond which the freight charges are too high.

Molten slag and hardened skulls are dumped from ladle cars on high fills built of rough slag blocks cemented together with molten slag. The slag when poured spreads out in the pits between these fills and gradually attains a depth of about 20 ft. A steam shovel with 5-yd. dipper excavates it when about three months old. The mass is laminated and breaks up readily, no blasting being required.

Side-dump cars of 6-yd. capacity are loaded by the shovel, and are taken in six-car trains by small locomotives to the foot of a cable incline at the crushing and screening house. Each car in turn is hitched to the cable, and before ascending it passes through a water spray from a perforated pipe forming a gallows frame across the track, in order to cool the slag and remove the dust. At the top of the incline two men release the chains on one side, and as the car body has the bulk of its load on the other side it promptly dumps into the bin around the head of a gyratory crusher. The car is then lowered, being switched automatically to the empty-car track at the foot of the incline.

Crusher-run product is elevated by a bucket conveyor and delivered to a 48-in. rubber belt conveyor which discharges it through a hopper to a rotary screen from which four sizes are spouted to storage bins. The remainder passes to an inclined flat rocker screen which



CRUSHER HOUSE WHERE SLAG IS PREPARED

grades it into the smallest sizes. The several sizes of the product are given in the following table:

PRODUCTS OF SLAG SCREENING PLANT

No.	Size	Use
1	Passing 4-in. screen; retained on 2½-in. screen	Base course, paving
2	Passing 2½-in. screen; retained on 1¼-in. screen	Base course, paving
3	Passing 1¼-in. screen; retained on ¾-in. screen	Concrete and roads
4	Passing ¾-in. screen; retained on ¼-in. screen	Concrete and roads
5	Passing ¼-in. screen and containing chips and dust	Waterbound paving and macadam maintenance
6	Passing ¼-in. screen; retained on ⅛-in. screen	Macadam finish
7	Passing ⅛-in. screen and containing dust	Screenings instead of sand

The bins are arranged over two loading tracks, so that the material can be discharged directly into cars for shipment. The crushing and screening plant can handle about 1200 tons daily. An electric motor of 100 hp., with rope drive, operates the cable hoist. A similar equipment with 125-hp. motor operates the crusher, elevator, belt and screens.

Removal of iron particles from the crushed slag is effected by a magnetized pulley at the discharge end of the belt conveyor. Thus, while the slag falls freely into the chute leading to the screen, the iron is retained on the belt until it has passed this point, where it is released and falls through another chute to a car for return to the furnace plant. With 1200 tons of slag handled daily the iron recovered is about 25 tons. Analysis of this Chicago slag is as follows:

Iron	None
Phosphorus	0.13%
Manganese	0.40 to 0.72%
Silica	36.50 to 37.50%
Alumina	12.60 to 13.20%
Lime	42.50 to 43.70%
Magnesia	5.10 to 6.70%
Sulphur (combined)	0.80 to 1.03%

The weight of the screened slag is about 2000 lb. per cubic yard, as against 2500 lb. for the limestone of the Chicago district. With its lighter unit weight, the slag will have greater bulk than an equal quantity of stone. For the same yardage, the lighter weight of slag will have a lower freight charge. The market price per yard is somewhat lower than that of stone.

The plant described above is that of the France Slag

Co. and is situated at the works of the Federal Furnace Co. The former company contracts to dispose of the entire slag output of the works, about 1200 tons per day. Some of it is prepared for concrete and road work, as described above, the remainder being used as filling for industrial and building sites, railway yards and similar purposes.

Extraordinary Rainfall Flooded Portions of St. Louis

Value of Numerous Gages Shown — Maximum Record of 3.6 Inch in One Hour More than Double Weather Bureau Record

BY W. W. HORNER

Engineer of Design and Construction, Sewers and Paving, St. Louis, Mo.

ON AUG. 24, 1918, there occurred in St. Louis an intense rainfall, which caused general flooding and damage to property throughout the city. The sewer system for the older portions of St. Louis has for a number of years been inadequate to carry off intense storms, even such as are liable to occur once a year, and in 1912, 1913, 1915 and 1916 a great deal of damage was caused on account of inadequate sewers and flooded cellars. In 1917 no severe rain occurred, and in 1918, up to about the middle of August, the city, in common with the Middle West, experienced a serious drought.

Beginning about Aug. 14, a period of moderate rains set in, resulting in a very high total of precipitation for the latter part of August and the early part of September. Aside from the high total, these rains were of little interest except that of Aug. 24, which was so unusual that a new record was set for intensity during a number of time intervals. In the southwestern portion of the city this rain began in the early morning, became a general downpour between 11 a.m. and 1 p.m., and degenerated into a light drizzle which continued until evening. At about noon all the sewers had become overcharged, the cellars in the lower part of town were generally filled, and water began to stand in the streets at the low points in grade. In front of the city hall the water was about three feet deep and covered the first floors of several stores. At the union station the flood was much worse, the water ran on to the main concourse and filled the baggage and express subways. Traffic was impossible across the 13th St. valley and the 20th St. valley, both street car and vehicular traffic being stopped. This condition was of short duration, and within a half hour after the storm ended surface conditions had become fairly normal.

Telephone reports of the rainfall record at the Weather Bureau indicated a maximum hour, between 12:35 and 1.35, of 1.52 in., and the total between 11 and 1 o'clock was slightly under 2 in. This entirely failed to explain the extent of the flood and the consequent damage. Fortunately, however, the city has for some time maintained a number of automatic rainfall stations, using a tipping-bucket gage. The record from the city gage at 613 North Garrison Ave. showed a maximum precipitation, for the hour between 11:20 and 12:20, of 3.60 in. Another gage, belonging to St. Louis University, about ½ mile distant from that at Garrison Ave., recorded a maximum hour's precipitation of 2.80 in. The Garrison Ave. value is much higher than any previous record of an hour's rain in St. Louis, and, of course, far above the points on the adopted rainfall curve for the city. The same is true of the intensities shown by the Garrison Ave. gage for all time periods between 20 and 80 minutes.

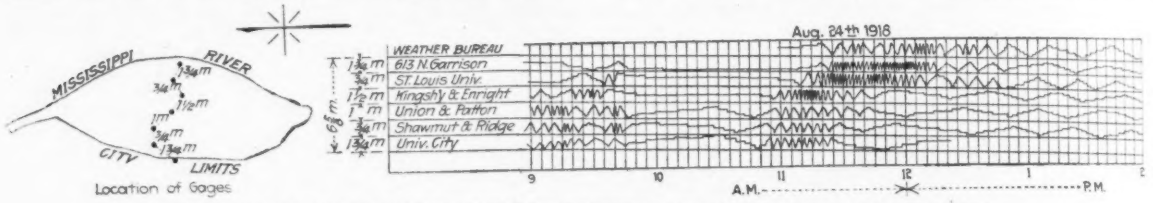


FIG. 1. RAIN GAGE CHARTS CLEARLY PICTURE THE CHARACTER OF THE STORM

The interesting features of this rain, from the viewpoint of the municipal engineer are (1) the excessive and record-breaking intensity; (2) the fact that these intensities did not occur at the official Weather Bureau station in St. Louis; and (3) the opportunity which the number of gage stations in service gave for study-

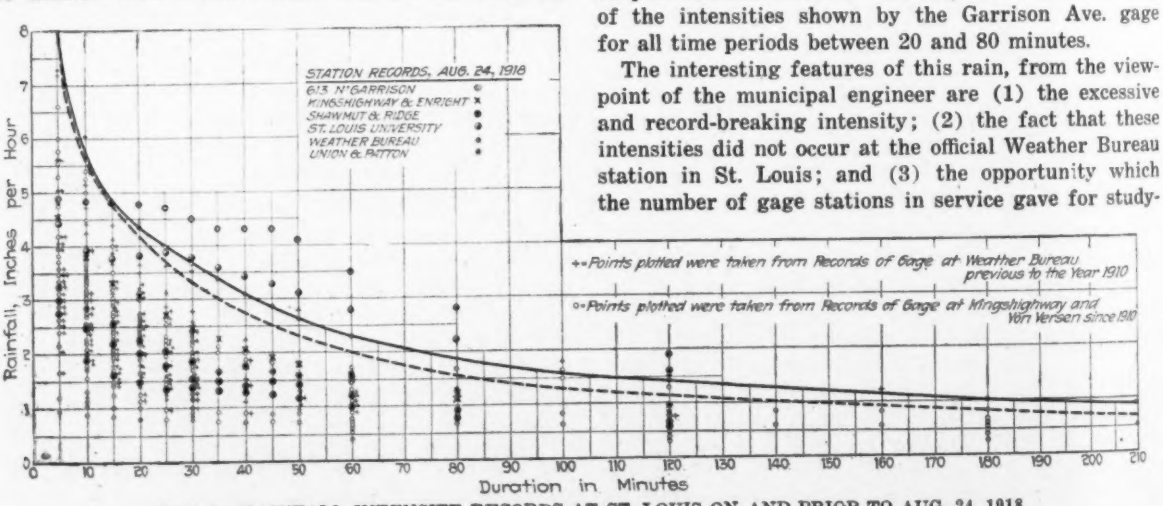


FIG. 2. RAINFALL INTENSITY RECORDS AT ST. LOUIS ON AND PRIOR TO AUG. 24, 1918

The full line rainfall curve was adopted for the design of the River Des Peres storm water sewer, November, 1916. The dotted line curve is the standard intensity curve for sewer design at St. Louis

ing the extent or area covered by the intense downpour. To illustrate this last phase Figs. 1 and 2 have been prepared. Fig. 1 shows the simultaneous records of seven stations situated in a general east and west line across the city. The distance between the extreme gages, that at University City and that at the Weather Bureau, is about 6.8 miles. The distances between the intermediate gages are approximately as shown on the margin of the chart. The record at University City is not taken from a tipping bucket, but from a standard gage collector attached by a drip pipe to a self-reading glass tube in the engineer's office. The actual mechanical record of the stations, shown in Fig. 1, indicate as clearly as can be done the relative intensities, duration and rate of motion of the storm.

The interesting points brought out on the chart are mainly the similarity of the first two records, the gradual lengthening at first indicated at the third station, the increasing intensity of the fourth, and the very severe intensities at the fifth and sixth stations, with the breaking up into two connected showers at the Weather Bureau gage. Note also the variation in the time of beginning of the heavy downpour, from 10:55 at the extreme western gage to 11:10 at St. Louis University, 11:20 at Garrison Ave. and 11:30 at the Weather Bureau.

On Fig. 2 are plotted intensity records for various time intervals at St. Louis. These records, except those of Aug. 24, were taken from the Weather Bureau gage up to 1910, and from the city gage at Kings Highway and Von Versen Ave. (Enright Ave.) since 1910. The two rainfall curves used in St. Louis are shown on this sheet, the lower one having been used for general sewer design, while the upper was proposed for the River des Peres main drainage project. Note that ordinates on the upper curve have never been exceeded more than once, while the great majority of records are much below it. When the Kings Highway-Von Versen Ave. records for Aug. 24 are plotted on this sheet, as usual they fall among the big bank of points and do not in any way affect the drawing of the rainfall curve. The records of the Weather Bureau are still lower. Considering either of these records, which would be the logical ones to compare with those previously plotted, there would be no occasion to modify the previously adopted rainfall curves. When the excessive values given at the St. Louis University and Garrison Ave. gages are also plotted on this figure they indicate clearly how inadequate a system designed for the values on the curve would have been to carry off this storm.

The writer is of the opinion that rainfall probability must be determined from continuous records at a single gage station and does not feel that even the excessive records caught at the two stations should be permitted to affect the economics of choosing a curve for sewer design. It is interesting to note, however, that the records of the single gage very easily fall short of predicting the extreme possibilities of precipitation and intensity, or that if this particular storm had passed over the Kings Highway gage it would have been logical to consider modifying the rainfall curve.

Unfortunately, there were no satisfactory gages on the north or south of this line through which the actual path of the storm can be determined. The best indications, however, seem to indicate that the path was a curve to the south of the line, striking the line at about the Garrison Ave. gage. Very clearly, it came from the west and probably south of the western gage. From the best evidence it would be judged that the intense downpour, at any one time, probably covered an area between 2000 and 4000 acres. In addition to the effect of the extraordinary intensity, the effect on the sewer system was accentuated by the movement of the storm in the direction of the flow through the sewer mains and at an approximately equal velocity. It may have been entirely possible, therefore, in so far as the effect on certain main sewers was concerned, for the severe intensity to have been active simultaneously over the whole area.

What Causes Railway Curve Resistance?

EXPERIMENTS conducted on the Canadian Pacific Ry. to determine the cause of curve resistance in railroad equipment and the character of any skidding of the wheels that may take place as a car rounds a curve, are described by John G. Sullivan, consulting engineer of the Canadian Pacific, in the July *Bulletin* of the American Railway Engineering Association.

Believing curve resistance to be due to the tendency of a cylinder to roll in a straight line, Mr. Sullivan had a car fitted with wheels of unequal diameter—those on the inside of sufficiently less diameter than those on the outside so that the diameters were exactly proportional to the radii of the two rails of an 8° 10′ curve. When the curve had been perfectly lined the car passed around it at speeds varying from 5 to 25 miles per hour without the wheel flanges on either side bearing against the rail heads, and the resistance, measured with a dynamometer, was 40 or 50% less than on straight track.

To get at the question of skidding, a car with wheels of equal diameter was run slowly around the curve, and the distance along the rail traversed by each wheel in making 70 revolutions measured; after which the car was moved back to the starting point and the distance traversed by each wheel in 70 revolutions measured again. The distance traveled in each direction was about 600 ft. The tabulated figures indicate differences as great as 4.87 ft. between theoretical and actual distances traveled, but Mr. Sullivan points out that if the outer wheel climbed the rail so as to ride ½ in. high that would give it an additional distance to travel of 4.862 feet.

The following conclusions are drawn by Mr. Sullivan from the experiments:

1. All outer wheels of railway equipment exert a pressure against the outer rail when rounding a curve.

2. The cause of this pressure is the tendency of a cylindrical body to rotate in a straight line at right angles to the axis of rotation.

3. There is never any skidding of either wheel of the leading axle of a truck unless it is a forward skidding of both wheels caused by the resistance to rotation being great enough to cause a slight retardation to rotation, which results in an apparent forward skidding.

4. There is no skidding of the outer wheel of a rear axle; in general, any skidding that does take place is on the inner wheel of the rear axle.

Engineering Colleges Teach Fighting Mechanics for Army

Housing, Equipment, Instruction Staff and Curricula Quickly Assembled—Automobile Mechanics Made in Eight Weeks

NEW educational curricula for making "fighting mechanics" in eight weeks, plant, equipment, staff, students and housing—all involving problems without precedent—were the main desiderata of various colleges, mostly engineering, last spring, when the army sent out through the committee on education and special training a call for auto mechanics, repair men, concrete foremen, gunsmiths, truck drivers and the dozen and one other classes of men skilled as to hand. Men who could do certain things well and on whom the army officers could depend to do those things; men with definite knowledge, rated and classified by others than themselves, so that their talents and ability could be placed properly and to the best advantage, were wanted. Most of the industries containing those men were already working at top speed, so that those who took the courses started in with no preconceived ideas. It was the intention that only those with fair common or grammar school educations should be trained, but at some schools it has been found necessary to give a course in simple arithmetic before men could proceed in a concrete foreman's course involving simple calculations as to volume, proportions of mix and form construction. These skilled workmen will all add greatly to the country's reconstruction ability after the war and will be worth many times the cost for that purpose alone, although the present demands for them both here and abroad is insatiable.

Typical of the auto mechanics' schools, and one of the first to get into the work, is the University of Pittsburgh's, described in *Engineering News-Record* of May 30, p. 1062. It contracted with the Government to teach, house and feed students at so much per capita per day. Seven two-story barracks of the regulation cantonment type, one 320 x 50-ft. one-story machine shop, and one 600 x 65 ft., a mess hall to seat 1643, an administration building and several smaller structures, were rushed through to completion last May in record time. No general contractors were employed, the university handling the work on a day's pay basis.

The machine shops were divided into bays 20 ft. wide and 25 ft. long, extending into the center of a runway. A bench with drawers for tools runs along the whole length of each side of the building at the window end of the bays. Storage space for car bodies, which are removed from the chassis as soon as the cars are delivered, is provided on a mezzanine floor. Slag is used for floors, although concrete and wood were considered. The slag absorbs grease quickly and is fairly clean—much more so, in fact, than any condition that may be expected with the Army in the field—and the expense is nominal. Also, the care necessary to keep bearings and wearing parts out of the slag is considered an essential part of the student's training.

Equipment consisted of thirty makes of old trucks and passenger cars, specimens of which were purchased outright. Arrangements were made whereby department stores, corporations and private owners of trucks and cars would lend their vehicles to the school for repair and complete overhaul, for a period of not less than 30 days nor more than 60 days. An overhead charge of $5 is made. The owner must buy and bring in parts to replace those broken or worn out. There is no charge for labor.

CROWN OF HILL AT UNIVERSITY OF PITTSBURGH UTILIZED ENTIRELY IN MAKING

No difficulty has been encountered in obtaining all the vehicles necessary, 165 cars and trucks having been overhauled up to Sept. 5, when a representative of *Engineering News-Record* inspected the school. The future policy will be to take in only trucks, for the work on trucks is considered more utilitarian, and plenty are available.

While the barracks are built from the plans of the cantonment barracks, the material used is of somewhat better grade, and the outsides of the buildings have been painted—the university authorities feeling that there would thus be more salvage value. Plumbing in the concrete-floored bath houses, for instance, is of enamel ware rather than of the galvanized iron used in many of the cantonments. Located on the highest of the university grounds, the wall-board finish inside will be appreciated by the occupants in zero weather.

Speed in feeding without confusion was the dominating thought in designing the mess hall, which is different from that of the cantonment type with kitchens at the ends. The kitchens here are at the center of one side, with storerooms and a built-in refrigerator room at each end of the same side. Students enter from a double door at the opposite side from the kitchen and at a pair of double doors at each end, making five entrances in all.

Tables for 10 men are supported by two 4 x 4-in. standards at each end. These are secured to the table proper by a pipe nipple, one end being screwed into the table board and the other into a coupling sunk into the 4 x 4-in. standard. This arrangement makes them easily removed and nestable. For legs, a 2 x 6-in. piece 30 in. long was let into the lower end of the standard, and a portion of the side next the floor was cut out to make a short bearing at the ends. The benches are separate from the table.

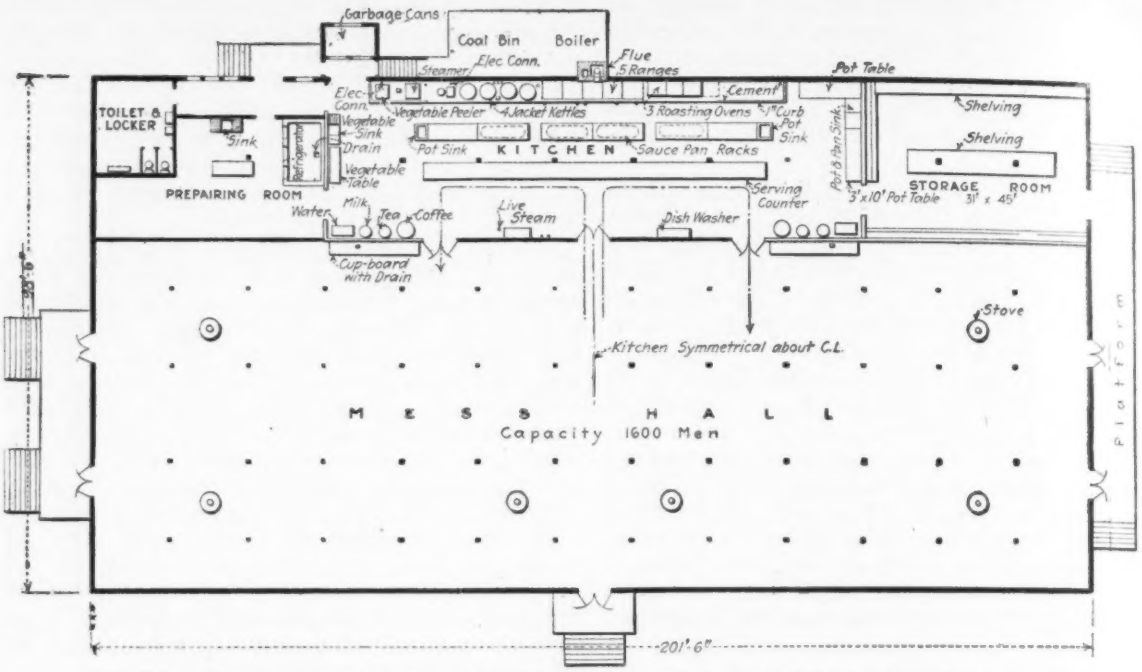
Time of the students in the shops is considered too valuable to require much kitchen police duty, but one man to each table of 20 men is detailed as a waiter. His only duty is to report 20 minutes before the companies march in, to set out the food. After everyone has been helped he estimates the additional amount needed and gets it from the kitchen. Every man must eat everything he puts on his plate, so the garbage from left-overs is a minimum. Everybody gets all he can eat and the steward states that some of the large men consume fully 100% more than others.

Kits of tools given each man, consisting of six wrenches, a cotter pin puller, a screwdriver and pliers, cost $1.78 each. A common stock room for each laboratory, with a storekeeper, has a complete assortment of tools necessary in automobile and truck work, besides a plentiful supply of nuts, bolts, cotter pins, etc. Each man is supplied with eight brass checks, on presentation of which, with the order from the instructor, he may draw tools. He must ask for them by the exact name, otherwise the storekeeper refuses his requests. Thus the training shades into the commercial end.

For the course which the men of better grade get toward the end of the period forty different makes of engines have been provided, so that intensive instruction can be given in ignition systems, carburetion and "trouble shooting." These engines are mounted in one of the permanent university buildings.

The staff consists of a chief instructor, a former superintendent of shops, and about 100 instructors. The procedure is to dismantle a car completely, so that no two parts are together. An inspection for new parts which the owner brings in, is then made. Ten men work on each car, usually apportioned as follows: Four on the engine, three on transmission and three on the rear end. After two days the men are switched, the instructor sizing up the men all the time, trying to find out the aptitude of each man. As each essential part is handled its function, wear, maintenance, etc., are explained with it in hand. Oral and written quizzer

FIGHTING MECHANICS FOR THE ARMY (1500 SOLDIERS ON THE WINDING ROADWAY)



THREE MESS HALL ENTRANCES PERMIT ENTRANCE, EATING AND EXIT IN EIGHTEEN MINUTES

are given nearly every day. As each instructor has the 20 men for a week only, the men get eight different instructors and a chance to work on 16 different cars.

Lectures, strictly nontechnical but given by technical graduates, are given three times a week, and these the student is required to study one hour each night, in connection with the text of Hobbs and Elliott's "Gasoline Automobiles," a copy of which is lent to each student for the duration of the course. Three complete sets of slides of every cut in the text have been made, so that the student has the identical illustration he has studied explained to him in lectures.

Each day's work is reported by the instructor, and at the end of the week he rates his men as apprentice, journeyman or expert on the type of work the man can do best. He is also rated on mechanical ability, speed, resourcefulness and personal qualities.

After eight instructors have rated a man it is usually

ALL KINDS OF WORK ON ALL KINDS OF CARS IN THE CHASSIS LABORATORY

easy for the office staff to fill up the final rating or transfer record. At the end of each week the groups of 160 are all broken up, so there is little chance for pairing off or "leaning on the other fellow."

In the instructions to the instructors rigid rules of conduct are laid down. All conversation is limited to the work of instruction, no familiarity between students and instructors being permitted. The conduct of commissioned army men is emulated, with good effect. In fact, each instructor is considered an officer during class hours. As they are accustomed to military discipline, little difficulty in this regard has been encountered. The men are most eager to learn.

When a student leaves this school his record indicates what he can do best: also his second, third and fourth best. If a man already is a skilled butcher, from years of experience outside, this is usually put down first, for the school authorities realize that an eight weeks' training cannot compare with years of actual experience. Thus the man does not lose the benefit in rating of what he had done previously. In fact, he has a definite rating on his general aptitude, in addition.

A new shop is now being added for a motorcycle contingent of 100 men, and the second unit of 100 sheet-metal workers is now in training at the Schenley High School, under management of the University of Pittsburgh.

This vocational work is under the general direction of Dean F. L. Bishop of the college of engineering, with Prof. H. E. Dyche as assistant director.

Concrete Floors Combine Steel and Concrete Frame

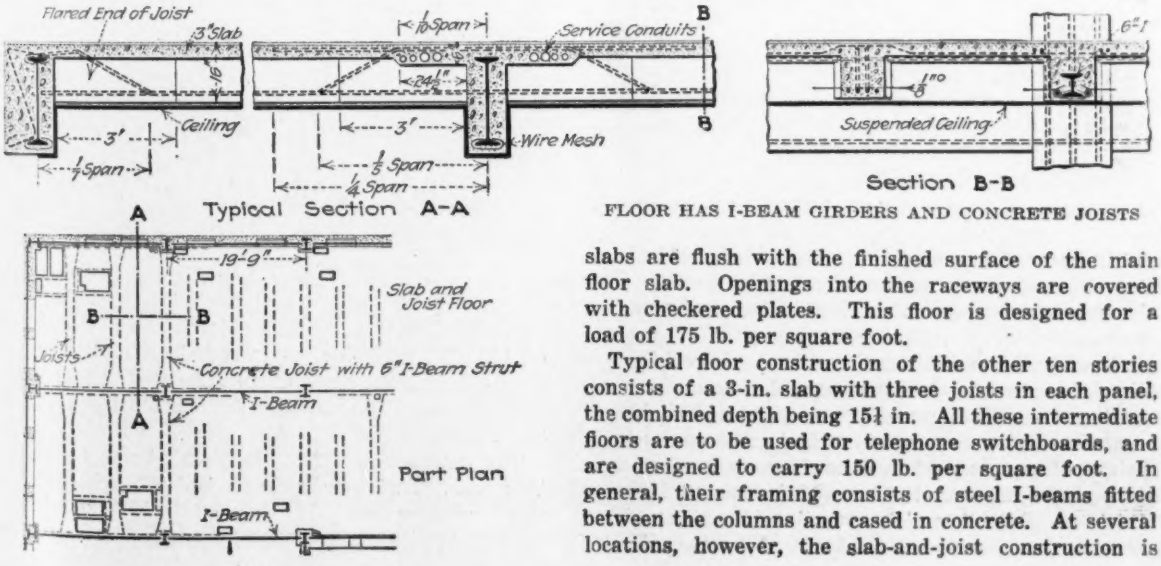
Slab-and-Joist Construction Carrying Loads of 300 Pounds to 150 Pounds Has Minimum Spacing of 4½ Inches Between Joists

CLOSELY spaced joists for heavy loads, recessed slabs to accommodate electric cables, and concrete joists reinforced by steel H-beams to act as struts, are introduced in the concrete floor construction of a new office building for the Chicago Telephone Co. The building is 180 x 130 ft. in plan and 12 stories high. All columns are of steel, of H-section, but the floor framing is of a composite character. Part of the floor area has steel I-beam girders framed between the columns, but in a large area the transverse girders are omitted, the slab-and-joist construction being continuous. The panels are approximately 20 x 20 feet.

One panel width of 20 ft. 8 in. along the entire 180 ft. length of one side of the first floor had to be designed for a load of 300 lb. per square foot, as it will carry rows of heavy lead-covered electric cables arranged on distributing frames. For this portion of the floor the 3-in. slab has joists 3½ in. wide spaced only 8 in. on centers. The depth is 17 in., this depth and the thickness of the slab being exclusive of the ¾-in. finish on the top of the slab. In the 4½-in. spaces between the joists are 4-in. vertical fiber sleeves through which the cables are led down to the basement and cable vault and thence to the underground ducts.

This panel is continuous, without transverse girders between the columns. On one side it is carried by a girder composed of a pair of 24-in. I-beams framed between the columns, while on the outer side it is carried by the retaining wall of the basement. Wood forms were used but were somewhat difficult to build on account of the depth, narrow width and close spacing of the joists. It was found easy to remove them, however, after the concrete had set.

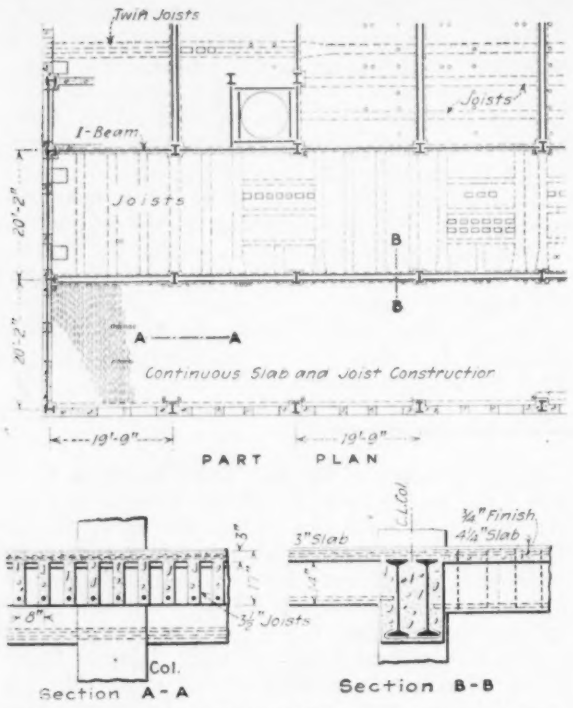
The slab of the tenth floor has to provide for a network of electric cables for the service of the American District Telegraph Co., on this floor. These cables cannot be embedded in the concrete, like those which carry wiring for light and other service. The slab is depressed, therefore, to form recesses or raceways, 3 in. deep, to accommodate the cables, so that on this floor the slab does not form a continuous horizontal plane. These raceways are covered with precast 2-in. concrete slabs reinforced with wire mesh, the joints being calked with an elastic cement. The tops of these



FLOOR HAS I-BEAM GIRDERS AND CONCRETE JOISTS

slabs are flush with the finished surface of the main floor slab. Openings into the raceways are covered with checkered plates. This floor is designed for a load of 175 lb. per square foot.

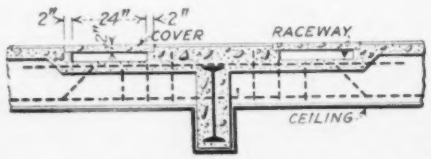
Typical floor construction of the other ten stories consists of a 3-in. slab with three joists in each panel, the combined depth being 15¼ in. All these intermediate floors are to be used for telephone switchboards, and are designed to carry 150 lb. per square foot. In general, their framing consists of steel I-beams fitted between the columns and cased in concrete. At several locations, however, the slab-and-joist construction is



CONCRETE FLOOR HAS VARIED DESIGNS OF JOISTS

continuous over several panels. Where this occurs on floor levels where column splices are made, H-beams are embedded in certain of the joists in order to act as struts between the columns.

In some of the outer panels only two joists are used, in order to allow of cable wells or other floor openings of specified dimensions. These joists are wider than the others, but are of the same depth. Widening of the joists at their ends by flaring out the sides is an unusual construction employed for the purpose of taking care of the shear, which is estimated at 60 lb. per square inch. Some of the joists also have inclined haunches at the ends, extending to the bottoms of the girders. Twin joists, half the normal width and about



RACEWAYS IN FLOOR SLAB CARRY TELEPHONE CABLES

12 in. apart, are used at certain parts of the first floor to permit of long narrow floor openings for cables leading between apparatus on this floor and the basement.

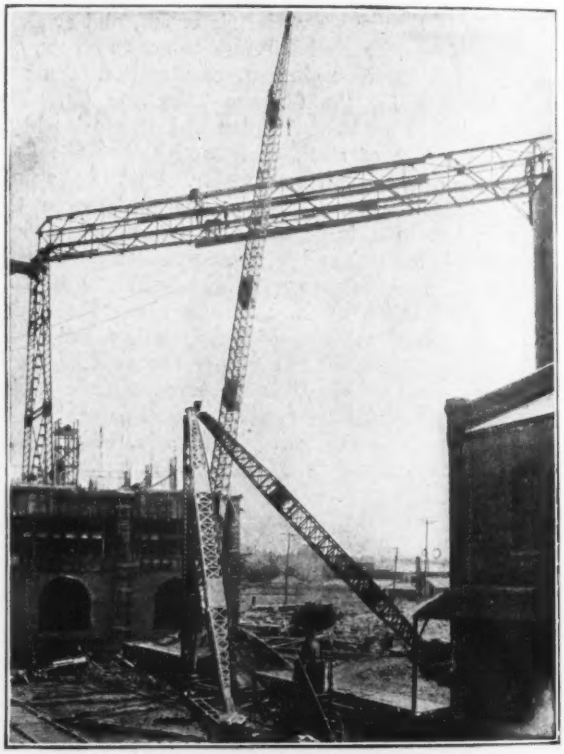
A suspended ceiling flush with the lower faces of the joists forms a flat surface and conceals the joist construction. This has a framing of ⅞-in. steel channels spaced on 12-in. centers and laid at right angles to the joists. They are attached to hangers on horizontal rods projecting from the sides of the joists. Increased thickness of the floor slab along the sides of the girders provides for the placing of electric light and telephone service conduits, which are embedded in the concrete, as shown.

The construction in general was designed according to units specified in the Chicago building ordinance, taking steel at 18,000 lb. per square inch and concrete at 700 lb. per square inch. Both the architectural and structural designs for this building were prepared by Holabird & Roche, Chicago.

Steel Derrick with 132-Foot Boom Handles 122-Foot Trusses

A DERRICK boom of exceptional length has been used in shifting steel truss spans carrying a belt conveyor system between a grain elevator and storage bins at the plant of the Russell-Miller Milling Co., Minneapolis. An extension of the plant made it necessary to rearrange the conveyor galleries, and after the spans had been stripped and disconnected the trusses were shifted singly by a stiff-leg derrick placed midway between the old and the new positions.

As the trusses were 80 ft. above the ground and had to be moved about 80 ft. to the new and parallel posi-



BOOM LENGTHENED TO 132 FEET FOR SPECIAL WORK

tion, the derrick boom was extended to a total length of 132 ft. by bolting up intermediate sections. This gave a horizontal reach of 40 ft. with full load. Box-lattice construction was used for the boom, stiff-leg and 37-ft. mast.

The trusses are 122 ft. long and weigh about four tons each. Owing to their length and light construction it was necessary, before moving them, to reinforce the chords by lashing heavy timbers to them, as shown

in the view. A cable sling carried by the hoisting block was lashed to the top chord, and guy lines controlled the movements of the truss while being swung. A 20-hp. steam hoist operated the derrick.

This work was done by the Minneapolis Steel & Machinery Co., Minneapolis.

Machine Dress Railroad Ties Before Treatment

Santa Fe Has Both Stationary and Portable Plants That Saw, Adze, Bore and Brand Ties in One Continuous Cycle

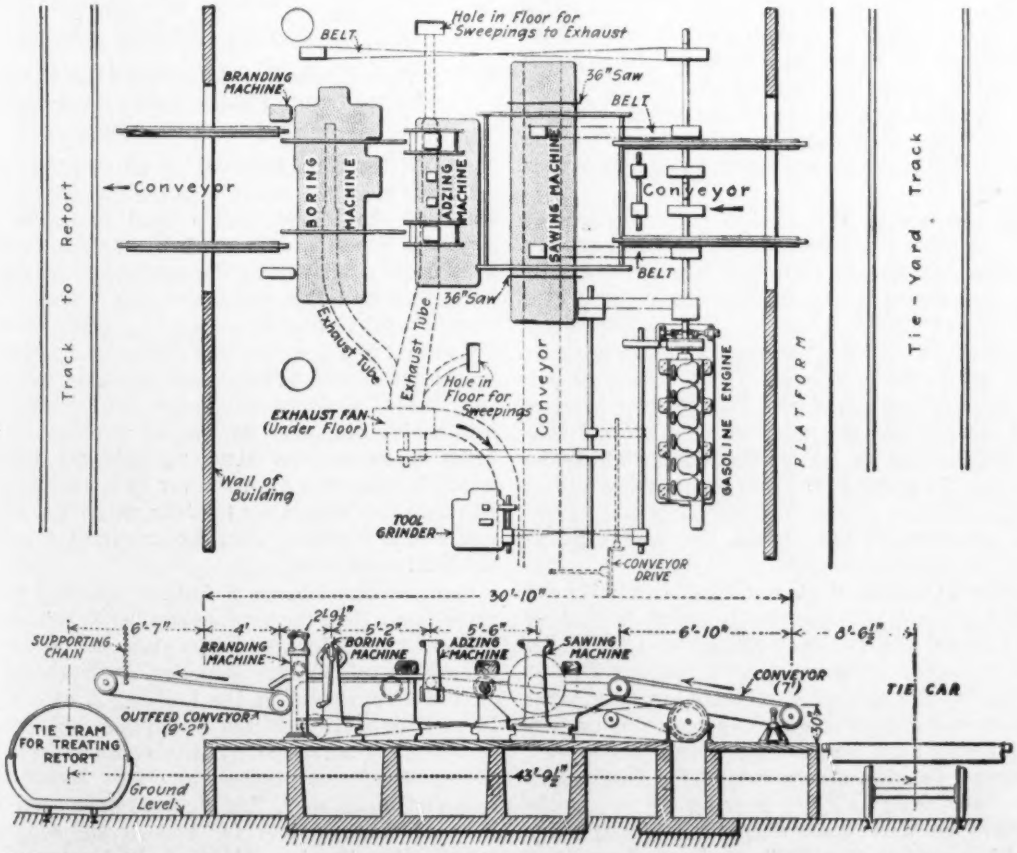
MACHINES have been developed to do all the cutting necessary to fit railroad cross-ties for their work before the application of chemical preservatives, in order to avoid subsequent removal of well treated parts of the wood. The Atchison, Topeka & Santa Fé Ry. has three stationary and two portable plants. In each case the machines are grouped to perform four operations, sawing, adzing, boring and branding, in a continuous cycle.

One of the stationary installations is shown in one of the drawings reproduced below. The tie first passes between saws which crop the ends. The seats for the rails or tieplates are then adzed or trimmed to a level surface, holes are bored for the spikes and finally the tie is marked or branded. For the special work of fitting hardwood spiking plugs in softwood ties there is a machine which bores and threads the holes, screws in the plugs and trims them off flush with the face of the tie. Conveyors automatically feed the ties through the machines and transfer them from one machine to the next.

At the receiving side of the plant seasoned ties from the storage yard are placed by hand or by a hoist upon a conveyor which delivers them to the first machine. The finished ties are fed to a conveyor which delivers them to the trucks for the heating retort or to railway cars for shipment. This discharging conveyor is mounted on a hinged boom, the end of which is raised as the car is loaded in order to prevent dropping the ties from a height. To avoid checking the discharge while cars are being changed, an accumulator conveyor has been devised, upon which the ties may be held temporarily. Cars and trucks may be shifted by a cable on a power-operated hoist or niggerhead.

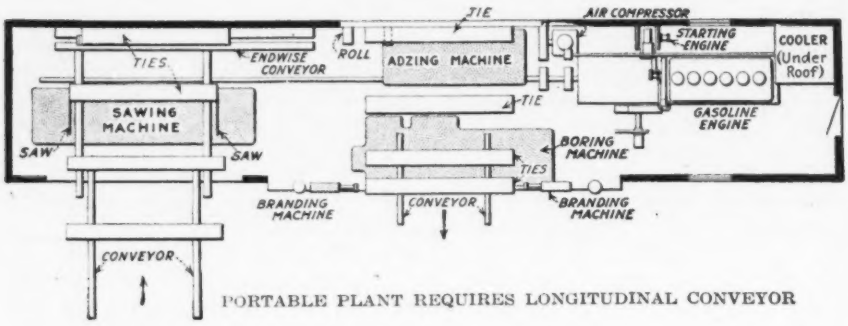
Cropping the ends of the ties by a pair of 36-in. circular saws removes weather-hardened surfaces which would retard penetration of the preservative. It also exposes indications of interior decay which may make it desirable to reject the tie. The two saws are mounted and driven independently. One is carried in a movable side frame, so that the width between the saws can be varied from 7 ft. 3 in. to 10 feet.

In the adzing machine the tie is passed over a pair of 11-in. expansion cutters which form a level face 10½ to 14 in. wide at each rail seat. While the tie is being fed



IN THE STATIONARY PLANT THE FOUR MACHINES ARE SIDE BY SIDE AND THE TIES ARE CARRIED STRAIGHT ACROSS FROM YARD TRACK TO RETORT TRACK

across the cutters it is held down upon its guides by a pair of weighted pantagraphs which operate automatically. Pneumatic cylinders or dashpots prevent shock from the drop of the pantagraphs as the tie passes from under them. Proper facing of ties which are crooked or irregular in surface is obtained by means of a compensator device or cradle. This automatically adjusts the guides on which the ties rest, so that the proper depth of cut will be made at each end. One of the cutters is carried in a sliding frame, so that the adzing can be done for different gages of track.



PORTABLE PLANT REQUIRES LONGITUDINAL CONVEYOR

In the boring machine the tie is held stationary by means of an intermittent conveyor while groups of bits or augers bore the spike holes from below. Each group may have two, three or four bits, mounted on spindles which are adjustable to fit various spacings of spike holes. To obtain proper location of holes in ties which are not straight there is a centering device having jaws which shift the tie horizontally so it will lie approximately on the center line between the two groups of spindles. Without such adjustment, a crooked tie might have some of the holes bored too near the side. The same device clamps the tie and holds it down while it is being bored.

Treated ties are usually marked with the date of treatment, in order that records of life may be kept. In the branding machine, the tie is held momentarily while the ends are stamped by dies fitted to the plungers of a pair of compressed-air cylinders. The hollow standards on which the cylinders are mounted serve as reservoirs for air at 60-lb. pressure. The characters are about 2 in. high and ¼ in. deep. It is common practice to stamp one end with the year and the other end with a mark designating the rail or tieplate for which the tie is bored. To prevent injury to the machine by ties which have S-irons driven into the ends to prevent splitting, the operator can cut out this device, allowing such ties to pass unmarked.

Ties from 5 to 10 in. thick and 7 to 14 in. wide can be handled without adjustment. Different lengths of ties and different gages of track are provided for by the adjustments noted. Removal of dust and shavings at the tools is effected by chutes, connected to an exhaust pipe, which may deliver to a cyclone separator or to a box car. Blocks from the saws fall upon a conveyor.

The second drawing shows one of the Santa Fé's portable plants, which permits dressing the ties in the storage yard, to save transporting them to stationary plants. This consists of a 50-ft. steel-underframe box car, fitted with the four machines already described and with an exhaust fan to remove shavings. The fan may deliver the waste to a separator or to a car which conveys it to the boiler house for use as fuel. An oil engine of 105 hp., using distillate, operates the tie machinery and a pair of niggerheads for cables handling the tie trucks. It is started by a 1½-hp. gasoline engine.

The car can be moved along the yard tracks at a speed of about 100 ft. per minute by means of chain drives on two axles, operated by the main engine. For transfer to another yard, these chains are disconnected so that the car can be hauled in freight trains. An auxiliary car or trailer contains two machines for sharpening the cutters and saws, an electric lighting plant with gasoline engine, and tools for ordinary repairs. Both cars are wired for electric lights on the inside and outside.

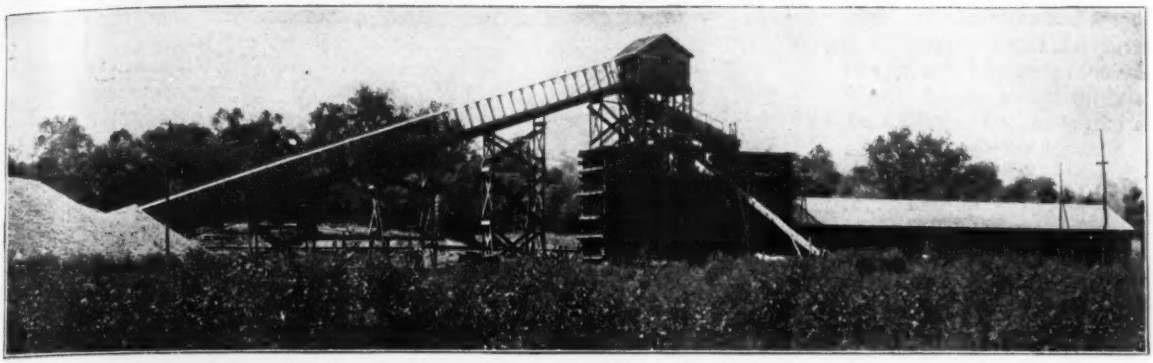
These tie-dressing plants have a capacity of 3000 to 3300 ties per 10-hour day. The machines, with their conveyors and other auxiliaries, have been developed by Greenlee Brothers & Co., Rockford, Illinois.

Concreting Plants Standardized for Five Miami Valley Dams

Pit Gravel Washed and Screened to Three Sizes Including Sand at Each Dam—All Processes Mechanical from Pit to Forms

MIXING plants identical in all principal features will place the concrete on the five retarding basin dams of the Miami Valley flood protection works. Available deposits, at each dam, of bank gravel, and substantial similarity of the concrete structures to be built permitted this standardization. Gravel brought from the pit in cars is elevated by a belt conveyor to the washer and screens. The excess sand and over-size gravel are chuted to spoil cars or waste banks, while the screened sand and pebbles drop into elevated storage bins which discharge by gravity through measuring boxes to the concrete mixer, the charging platform of which is connected by a runway to a cement house in line with the bins. Cars take the concrete to the work, where it is placed by derricks or chutes, according to the local conditions.

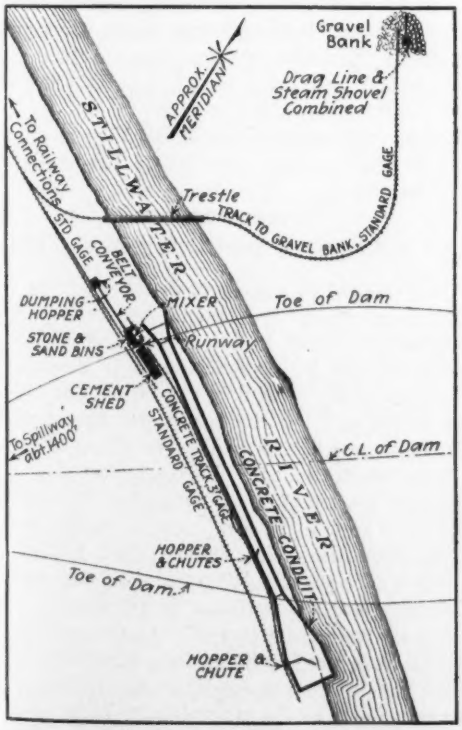
Concrete construction is farthest advanced at Englewood dam. Here the plant is completed, and concreting the outlet conduits was begun Aug. 10. Other plants are not far behind in construction, as the accompanying picture of the plant at the Lockington dam indicates. In fact, concreting at the Lockington and Englewood dams started the same day, after several weeks of good-natured rivalry on preparatory work. Except for surrounding topography, this picture might serve for the plant at Englewood or for that at any of the other dams. Also, the description of the Englewood operations applies, so far as the washing and screening outfit,



GRAVEL-WASHING AND SCREENING AND CONCRETE-MIXING PLANT IDENTICAL FOR FIVE DAMS

bins and mixer and cement house are concerned, to every one of the five plants.

At the Englewood dam the volume of concrete to be placed is 38,000 cu yd., the larger part in the outlet conduits and the next larger part in the structures of the spillway around the west end of the dam, about 1400 ft. distance as the crow flies. The shortest average haul for mixed concrete, therefore, determined the location of the plant near the headworks of the outlet conduits, as indicated by the sketch map. From one end of the outlet work to the other end is about 1000 ft., making the average concrete haul approximately 500 ft. The spillway is a channel about 1400 ft. long, with concrete side walls, an overflow weir and an apron. Its whole curved length is within a radius of perhaps 1500 ft. from the mixer plant, so that a track running its full length and to the mixer would measure perhaps three-fifths of a mile. The exact average haul of spillway concrete will depend on the track location. The distances given serve principally to indicate the fairly long haul of mixed concrete at Englewood and bring out the importance of the hauling outfit to be mentioned.



MATERIAL HANDLING A CONTINUOUS MECHANICAL PROCESS FROM GRAVEL PIT TO FORMS

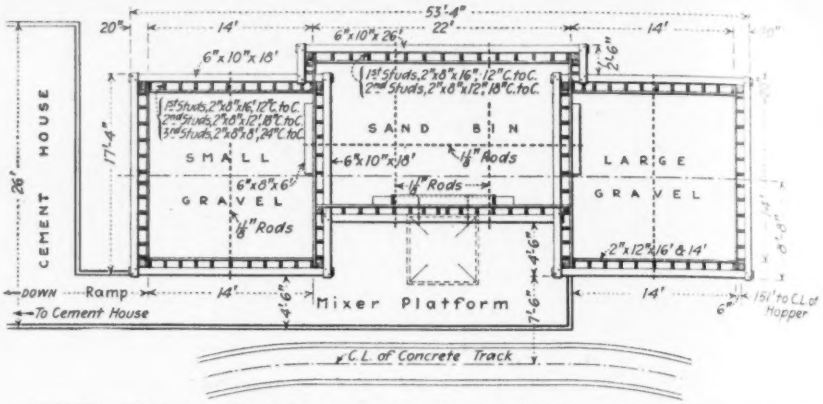
Concrete is now being placed only in the outlet works, and the track layout given on the plan is tributary to this work. The map shows the continuous routing of materials from the gravel pit to the conduit forms. The supply and preparation of the concrete materials are the first link in the chain of operations, mixing and transporting concrete are the second link, and distribution to forms is the final link.

Bank gravel is excavated by a small drag-line excavator, equipped as a steam shovel, from a pit above the dam and some 1500 ft. by railway from the dumping hopper of the gravel washing plant. Four-car trains of 12 cu.yd. air-dump cars and a 40-ton saddle tank locomotive, carry the gravel from the pit to the hopper. This same type of equipment does practically all the job hauling. This statement does not of course refer to materials and supplies coming to the work from the outside. These are brought in by standard rolling stock. The switch to the dumping hopper reaches alongside and past the bins and the cement house. This permits cars of cement to be shunted in front of the cement house and dump cars to be spotted beside the bins to receive the waste washings and the oversize stones from the gravel washer and the screens.

Sand and two sizes of pebbles are produced by the washing and screening unit. A pyramidal hopper set at ground level in a concrete pit receives the pit gravel by side dumping from the cars. The hopper is 19 ft. 2 in. x 7 ft. 10 in. inside the top and is built of timber. An opening at the bottom feeds the gravel onto a 20-in. belt conveyor. This belt rises on a 20° incline on a trestle to the washer above the bins, traversing a horizontal distance of 161 ft. The washing and screening equipment above the bins comprise three screens in a row, each screen 54 x 27 x 72 in., a 60-in. conical sand separator, and a 4-in. centrifugal pump. A 25-hp. motor is direct-connected to the pump, and the belt and screens are operated by a 20-hp. motor. Screened sand and gravel drop into the bins, and washings and oversize stones are chuted to one side into spoil cars or waste bank.

Solid-wall bins from the ground up were constructed as shown by the general view and the plan drawing. It will be noted in respect to the bin layout, besides

the three-compartment construction, that the mixer skids are not set much above ground level and the concrete track is in a cut below ground level, so that the mixer has room to tilt and discharge. A 1-yd. mixer receives its sand and stone by chutes designed so that both materials are measured in the chutes. Cement is wheeled from the cement house with which the mixing platform is connected by a runway and ramp. At Englewood the outlet conduits are being built in a deep rock trench, with the sides nearly vertical. Direct chuting from the track level was therefore possible in concreting the greater part of the length of the conduit structures. A 3-ft.-gage track from the mixer was carried alongside the trench and close to its edge. On this track, hopper cars arranged for side gate discharge are hauled by a gasoline locomotive. At points where concrete is being placed, platforms are bracketed out over the edge of the trench and fitted with floor hoppers into which the cars discharge. Chutes on trestles deliver the concrete from the platform hoppers to the forms.



THREE-SIZE AGGREGATE BINS FEED MIXER THROUGH MEASURING CHUTES

About 300 cu.yd. a shift is the capacity of the concreting plant, and some 20,000 cu.yd. of concrete is the season's scheduled work. The dam is part of the flood protection work of the Miami Conservancy District, of which Arthur E. Morgan is chief engineer, Charles H. Paul assistant chief engineer and C. H. Locher construction manager. H. S. R. McCurdy is division engineer on the Englewood dam.

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

Des Moines Engineers' Club Widens Ideas

To bring engineers in closer touch with civic and industrial matters, the Engineers' Club of Des Moines, Iowa, is planning to have at each meeting a speaker from one of the city departments or one of the various industries in the city, and occasionally speakers from other cities. The speakers will be expected to explain in detail such matters as the management or organization of their respective activities, their factory or plant methods, machinery equipment, accounting and financing, and efficiency methods, used or contemplated. At nearly every meeting some officer in Government service speaks in regard to army activities, especially along engineering lines. Social activities are recognized as necessary to the development of the club, and these are taken care of at each meeting by the committee on entertainment and program. A new constitution and by-laws have been prepared and will be discussed. After their adoption steps will be taken to increase the membership. Monroe L. Patzig is secretary and treasurer.

Twin City Engineers Find 80,000 Tons of "White Coal"

THAT horsepower equivalent to 80,000 tons of coal per year can be developed at the High Dam on the Mississippi River within six months is the gist of a constructive report made by a committee of the Engineers' Club of Minneapolis through the Civic and Commerce Association to the War Industries Board. This summer there was a deficiency of water power in Minneapolis due to extremely low water, and prominent citizens woke up to the fact that war orders could not be handled unless more power was available. Other sources of power, steam and hydro-electric, being developed were tabulated by the society's committee for the use of the Government body. Undoubtedly, upon these data will depend order placements.

The report was not hidden and the Minneapolis papers printed abstracts on the front pages. Publicity of this kind is easy to get.

Army Engineers Want Societies Kept Up

From a captain of engineers in France came a letter recently about society service. It speaks for itself.

"Just as you in the States are inclined to look to us over here for the heroic stuff, so we in France are inclined to feel that the real big things in the awakening of the nation and the shaping of its future course in world affairs are taking place over there, and that we in France constitute only the producing arm of force actuated by the new national consciousness. Those of us who have been in France for over a year have difficulty in visualizing the war-vitalized United States of to-day, and therefore letters that convey direct personal impressions are particularly welcome.

"When the war came on and the services of so many engineers were needed in various capacities, I rather expected that interest in meetings of technical societies, more particularly of the mutual betterment kind, would lag, but I am agreeably surprised to learn from your

letters, and from occasional copies of *Engineering News-Record* that reach me, that such is not the case. Now is the time to advertise the usefulness of the engineer in a way that will make an impression. We who are now in the Army will be looking for a means of livelihood when the war is over, and hope that those who have remained behind will be able to convince the country that the great amount of beneficial constructive work that has been stimulated by the war ought to be continued in time of peace."

A number of societies are reporting a serious impairment of finances, and in consequence are considering a curtailment of activities. The dross should be eliminated. Wise council should be sought. Directors should meet frequently and be sure that the really live, essential work proceeds. Some organizations have reserve funds built up for a "rainy day." The boys over there are looking to the States for constructive effort, now as never before. If new blood cannot be drawn in, and if expenses eat into the reserve, it is well to remember that it's "raining" now, and appropriate the reserve without stint or qualms. W. W. DEBERARD.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

National and Local Societies

Sir—Mr. Hoyt's interesting and timely letter in your issue of Sept. 5, p. 463, touches upon a subject in which the whole engineering profession is profoundly interested. The organization of the many national and local engineering societies so as to harmonize and coördinate their efforts, and so that the engineering profession may be mobilized locally or nationally whenever its influence or its service is required by the community, is the most vital problem before the engineering profession today.

Mr. Hoyt's pessimism with regard to the national societies, however, I cannot share. The momentous resolutions recently passed by three of the founder societies, appointing committees on "development" or "aims and organization," is the clearest indication that the importance of broadening the scope of our activities and the necessity of national organization are appreciated. A thorough and general discussion will be carried on by the national societies this winter, and it is confidently hoped that a crystallization of ideas will result, and a plan of liberal coöperation among all engineering organizations.

There is an important feature in the formulation of such a plan that must not be overlooked. Mr. Hoyt emphasizes the desirability of national organization under the leadership of the large national societies. That these societies are able and willing to assume such leadership can hardly be doubted, in view of recent developments. However, any program of organization must be the result of discussion and coöperation actually nation-wide. Only in this manner can a plan of organization be worked out that will meet with the hearty indorsement and support of the whole engineering profession and that will not be suspected of a desire for centralized government, so odious to localities removed from New York. In full recognition of this situation, the resolutions creating the committees of the national societies provide for representatives of all their local sections and from all parts of the country.

May we suggest to each one of these committees the motto "to discuss aims and purposes in the light of modern development and in the light of present-day thought, and to help toward finding a method of coöperation with the rest of the engineering profession best suited to attain these aims." LOUIS C. MARBURG.

New York City.

Surface Heaving Caused By Segregation of Water Forming Ice Crystals

Sir—The differential lifting of the surface of the earth, in regions where the temperatures fall below freezing, frequently results in the development of cracks in hard surface pavements and the displacement of piers and other structures. Such phenomena are almost universally ascribed to frost action, but the mechanics of the process has not been clearly understood. The annual damage to concrete pavements by frost is considerable, and if this loss is to be prevented highway engineers must learn the true cause of the trouble.

Expansion in volume due to the freezing of water is commonly given as the cause of heaving, but this theory does not furnish a complete explanation of all the facts. In a paper in *Engineering News-Record* of Feb. 7, 1918, pp. 262-263, the present writer attributed the lifting of certain concrete piers to the segregation of water to form ice crystals, rather than to the expansion in volume which occurs when the water freezes. The latter theory has been discussed by several engineers in recent issues of engineering journals, and a number of interesting observations on heaving by frost have been placed on record.

It is obvious that expansion due to the freezing of water in soils must usually result in some elevation of the surface, but the changes in elevation caused in this way should be approximately the same wherever the soil saturation is uniform. Most of the damage resulting from heaving is due to strain induced by the unequal lifting of the different parts of a pavement or structure. In fact, this unequal elevation of the surface is the most noticeable phenomenon associated with frost heaving. J. L. Harrison in *Engineering News-Record* of Feb. 28, 1918, p. 419, has called attention to the fact that after the heaving of a concrete pavement "it is often possible to push sticks between the blocks and the base," while some cases have occurred "where it was possible to see clear across the subgrade under concrete blocks."

Another characteristic phenomenon is that in many instances the depth to which freezing extends is insufficient to account for the amount of heaving observed, if the latter be attributed solely to the expansion accompanying the freezing of ground water.

C. D. Norton in *Engineering News-Record* of May 30, 1918, p. 1058, cites several cases, which he states "seem to demonstrate that the ground heaves or rises in the winter because the water in the soil expands," but the

writer cannot agree with him. In only one instance does he give exact figures and, in this case, the evidence apparently disproves his theory. According to Mr. Norton, in a region where the ground freezes to an average depth of 4 ft. one of the sills supporting a cottage was lifted 4 in. Now, the change from water to ice is accompanied by an expansion of 8.55 per cent., and therefore it would be necessary to freeze a column of water 46.78 in. high in order to raise the surface 4 in. Assuming that the soil was completely saturated with water and that the pore spaces averaged 40 per cent. of the total volume, which is certainly an excessive estimate, then freezing would have to extend to a depth of *nearly 10 ft.* in order to raise the surface 4 in. Moreover, the heaving was very uneven, for, according to the diagram accompanying the paper, one of the posts under the cottage was heaved only 1 in., while another was heaved only ½ in. Mr. Norton refers to the absence of ice between the sheathing and the ground, but this is to be expected where the sheathing and sills are of wood, for wood is a poor conductor of heat. He would probably have found some ice below the surface if excavations had been made.

In the writer's experiments, which have already been described, a layer of ice was formed immediately under a metal weight, because the latter radiated heat rapidly and therefore acted as a refrigerating surface. In much the same manner, ice will sometimes form between a concrete pavement and its sub-base. The formation of ice veinlets in clay, as shown in the photograph published by Lewis B. Wyckoff in *Engineering News-Record* of Mar. 28, 1918, p. 627, is an excellent illustration of the fact that under certain conditions ground water, on freezing, will segregate to form relatively pure ice. In the Yukon and other very cold places masses of clear ice several feet in thickness are sometimes formed at shallow depths below the surface. Now, in all such cases it is evident that the segregation of the water took place simultaneously with its crystallization as ice, for soil and other materials of high specific gravity will not float on a layer of water.

When ground water in freezing segregates to form clear ice, it is due to the fact that the growing ice crystals are able to extrude the foreign material with which they come in contact. The formation of layers of relatively pure ice is necessarily accompanied by an elevation of the surface which bears no relation to the average depth of freezing, and in many instances the amount of elevation may be practically equal to the thickness of the ice layers that are formed. In most instances the ground water freezes in the interstitial spaces so that the soil particles become inclosed within the ice. Where this takes place the elevation of the surface results from the expansion in volume that accompanies the freezing of water, and the amount of elevation depends chiefly on the depth to which freezing extends and the percentage of water that is present in the soil.

The conditions under which the water present in soils segregates to form masses of relatively clear ice must be understood before preventive measures can be intelligently formulated. The experiments of the writer, which were not confined to ice but also included a large number of crystalline substances, indicate that the size of pore space is usually the most important factor in determining whether the formation of ice from ground water is accompanied by the inclusion or the exclusion of soil particles.

When a growing crystal is surrounded by foreign material in which the pore spaces are large, as for example in clean sand or gravel, the pressure is unevenly distributed over the crystal surface, and while growth is relatively rapid on the exposed areas it is much slower on the surfaces which, because of their close contact with the foreign bodies, are less accessible and therefore require more time for the supply of new material through the infinitesimal spaces. Under these conditions the crystal tends to grow around the foreign bodies. On the other hand, when the pore spaces are small, as in clay, pressure is more uniformly distributed over the crystal surface, growth is slow and new material may reach practically the entire surface of the crystal with equal facility. Under these conditions the growing crystal tends to exclude the foreign bodies.

Noticeable heaving by frost, so far as the writer has been able to ascertain, is practically confined to clays and other soils in which the pore spaces occupied by water are extremely small. Where the interstitial spaces are relatively large, no appreciable heaving seems to occur. This observation has been confirmed by several of the writers in recent issues of *Engineering News-Record*.

In order that freezing may take place, the temperature must be sufficiently low, and the freezing point is lowered by pressure at the rate of 0.133° F. for each additional atmosphere of pressure. During the formation and enlargement of masses of ice in soil, pressure is exerted against the inclosing material, and therefore the ice tends to form along planes of cleavage or weakness. In other words, concretionary ice tends to form at those places where the least energy is required in making room for the growing mass.

At a given depth the freezing temperature will be reached first at those points where radiation of heat is most rapid. Also, since water does not freeze so readily when confined in very small capillary spaces, the ice will form first in the larger openings in soils. After ice begins to form at a certain point there is a tendency for crystal growth to continue at this point rather than form new centers of crystallization.

The thickest layers of clear ice resulting from the freezing of ground water seem to form under objects that radiate heat rapidly, and at times when the temperature of most of the ground water near the surface is considerably above freezing while the temperature of the air is well below freezing. Under these conditions a film of ice forms first on the under surface of the refrigerating object and gradually increases in thickness because of the freezing of additional water that slowly reaches the lower surface of the ice through the small capillary and sub-capillary spaces in the soil. A relatively high temperature of the ground water at lower depths lengthens the time required to bring the temperature to the freezing point, and thus retards the development of new centers of crystallization at points which are otherwise favorably located.

STEPHEN TABER,
State Geologist and Professor of Geology, University of South Carolina.
Columbia, S. C.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Keep Steam Shovel Crews Unchanged and Cut Moving Costs

MONEY is saved moving steam shovels by keeping always the same crew on the shovel. For this reason, on a large excavation job visited not long ago shovel crews are never changed if it is possible to avoid change. By practice, a crew thus becomes expert and quick in shifting the shovel. In some cases a reduction from 5 min. to 2 min. in moving time per move has been accomplished. It costs from 3c. to 12c. per minute to operate a steam shovel, including the wages of the pit crew. Let us say that ten shifts of the shovel are made per ten-hour working day. Three minutes per move saved, then, aggregates a saving of 30 min. per day. Assuming an average cost of operation of 6c. per minute, the saving in cost per day is $1.80, and per month, 26 working days, it is $46.80. Working two shifts per day, the saving per month is $93.60. Of course, if poor spoil-train service or carelessness in many other possible ways keeps the shovel alternately idle and busy, this gain in speed of shifting the shovel counts little. On the work visited the other factors of plant coördination had been figured quite as closely. Incidentally, one of the most interesting problems of plant coördination in all engineering construction confronts the superintendent of a steam shovel excavation job.

C. S. H.

Other Articles of Interest to Contractors In This Issue:

Plant Prepares Slag for Roads and Concrete Page 671

Steel Derrick with 132-Foot Boom Handles 122-Foot Trusses Page 678

Concreting Plant Standardized for Five Miami Valley Dams Page 680

Shallow Street Excavation Cost Cut Seventy Per Cent by Shovel

BY GEORGE BIGGS
Kansas City, Mo.

THE cost of excavation was reduced 70% when a steam shovel was substituted for wheel scrapers and an elevating grader on shallow street grading at Kansas City, Mo. The material removed was Tarvia macadam, containing a comparatively small amount of rubble for this type of pavement, and the depth of cut was about 13 inches.

Before putting the shovel on the work an attempt was made to use the wheel scrapers, and later an elevating grader was tried. The wheelers failed on account of the difficulty in loading the hard, compact material. The elevating grader was seriously handicapped by the heavy street-car traffic, which interfered with the receiving wagons. However, it is believed by the engineer in charge that this latter method of handling old macadam would be entirely successful on wide streets without car tracks. After one block had been graded and costs had mounted to 42c. per square yard, operations were shut down pending the arrival of the shovel. Immediately after its installation, costs fell to about 14c. per square yard, and on certain days were as low as 12c. per square yard. Upon a high fill costs were further reduced by wasting over the wall at the side. Labor, fuel and rental of the shovel, at $50 per day, were included in the cost as given.

Excavation by shovel was found to give a better grade than was obtained by either the wheelers or the elevating grader, and the fine grade, which is shown in the illustration, was easily obtained. The type of pavement constructed was 4-in. vertical fiber brick on a 1-in. sand cushion and an 8-in. concrete base.

The work was done by the A. Jaicks Co., under the superintendence of Wilson A. Jaicks, and the cost data were compiled by the writer.

SHOVEL CUT TO EVEN DEPTH AND MADE ROLLING EASY

Engineers Who Design Also Supervise Work

Preparation of plans and estimates for sewer projects under the Board of Local Improvements, Chicago, is in the hands of the engineer force of the division in which the project is located. The adoption of this system gives the construction engineers familiarity with designing and the purposes of design. When followed closely, it will enable the division force to work out details, and then design them and make the necessary drawings, so that when construction is in progress under the same men they will have become familiar with all details. One drawback is that the drawings made by the engineers and rodmen have not as finished a style as if prepared by regular draftsmen, but it is expected that this defect will gradually disappear as the men become experienced in drafting.

NEWS OF THE WEEK

New York, October 10, 1918

Jubilee Convention Held by American Society for Municipal Improvements

Revised Constitution Accepted—Paving and Sewage Discussed—History of Society Reviewed—Resolutions Adopted

Celebration of the twenty-fifth anniversary of the organization of the American Society for Municipal Improvements was a feature of the convention held by that organization Oct. 2 to 4. Fittingly, the meeting place was Buffalo, where the first meeting was held in 1894. On the technical program, pavements and sewage treatment were the main topics.

A revision of the society's constitution, prepared by a committee having George W. Tillson as chairman, was adopted. The word "of" in the name of the society was changed to "for." Under the new constitution, standing committees will continue to guide the constructive work of the society. Reports of the various committees on specifications will be circulated, so far as practicable, before the annual meetings. There will be hearings on the reports during the meetings, after which reports will be presented for general discussion on the convention floor. After discussion, the convention will vote on submitting the specifications in question, or amendments, to letter ballot, subject to adoption by a majority of those voting.

Buffalo Paving and Street Cleaning Practice

Among the papers on paving and street maintenance presented were three on Buffalo practice, which are abstracted on p. 663. In discussing the paper on concrete base by George F. Fisk, the question was asked whether concrete bases are not made unnecessarily thick. C. E. P. Babcock, Buffalo, said that question could be answered in the light of local conditions only. G. H. Norton, Buffalo, believed that it would be impossible to limit the loads over payments, and if heavy loads are allowed on heavy traffic streets it would be impossible to keep them entirely off the light traffic streets. He cited the fact that the pavements of Buffalo are being used by the Pierce Arrow Co. in testing its large trucks, which receive a 100-mile test run when loaded to capacity with cast-iron cubes. In answer to a question as to how the contractors' gamble could be eliminated, when the system is used of changing concrete mixes after delivery of material, Mr. Norton said that the contractor should get well-graded material in which there would be no need for change.

In discussing the paper on asphalt maintenance by Messrs. Babcock and Vandewater, a question was raised as to whether old asphalt taken up could be used again if more asphalt were added. Discussion indicated that trying to use old asphalt costs as much as or more than using new.

A paper by J. R. Draney, New York City, on standardizing the consistency of asphalt, urged that a smaller variety of penetration standards is desirable. The author recommended that steps to reduce the number be taken by the various societies interested.

William C. Perkins, chief engineer of the Dunn Wire-Cut Lug Brick Co., Conneaut, Ohio, read a paper on prevention of longitudinal cracks in hard surface pavements. He proposed the use of a course of hollow tile on the subgrade to insulate the subgrade so that frost will not penetrate it, and to collect and direct to the gutters any water that may rise through the subgrade.

Thomas E. Collins, city engineer of Elizabeth, N. J., read a paper entitled "Napped Trap Block Pavements." These pavements are similar to recent granite-block pavements and are rebuilt from old trap-rock pavements of large-sized stone which are cut through the middle, the new surfaces thus formed serving as the wearing surface. These blocks are laid as are other blocks, except that the author recommended ramming them after instead of before the application of the first grout. This he thought necessary because of the omission of pebbles to fill the lower portions of the joints.

A. T. Rhoads, field engineer, Granite Block Manufacturers' Association, stated that it is feasible to ram block before the first grout is applied, if the blocks are uniform in size, whether pebbles are used or not. He felt that if the ramming is left until after the first grout is applied it is imperative to ram immediately after such application.

Short papers on concrete bases for bituminous and other pavements, and on concrete pavements, were submitted by W. A. Hansell, superintendent of public works, Fulton County (Atlanta), Georgia. A new method of protecting concrete while curing was suggested. It consists of giving the surface a coat of bituminous material as soon as it has set sufficiently to make it safe, and covering this with enough stone to absorb the bituminous material used. This, it was stated, will protect the pavement while setting and also when the traffic is turned upon it. Tar-asphalt has been used successfully for this work, the author stated, and its use is much more satisfactory than the old method of covering the concrete with earth and keeping the earth moist for several days. The writer also recommended a wooden roller with spikes for finishing bases for bituminous tops, thus obtaining a roughened surface. E. C. Conant, Savannah, Ga., favored the use of loam kept thoroughly moist, for protection while curing.

Sewage Disposal Receives Attention

A group of papers on sewage disposal and treatment occupied a large part of a forenoon. One of these, by Capt. F. A. Dallyn, of the Ontario Board of Health, was of unusual interest because it made public the conclusions and recommendations of the International Joint Commission, reached after studying for six years the question of the control of the pollution of the boundary waters between the United States and Canada. These conclusions are printed on p. 660 of this issue. Papers by G. H. Norton and by Carl L. Howell dealt with sewerage and sewage disposal at Buffalo and vicinity. Morris Knowles, Pittsburgh, sent a paper reviewing sewage disposal by various European and American cities, and outlining the scheme adopted by several Canadian towns across the river from Detroit, which are building a joint sewerage system under a district organization called the Essex Utilities Commission. Venturi meters will be used to distribute operation costs among the various towns. Prof. C-E. A. Winslow

(Concluded on page 691)

Engineers Study Flood Dangers in Imperial Valley

The board of directors of Imperial Valley, accompanied by C. K. Clarke, chief engineer; C. E. Grunsky, consulting engineer, and C. R. Rockwood, formerly general manager and chief engineer, recently made a tour of inspection over the levee system. The Colorado River, since the break in the Ockerson levee in 1910, has changed its bed and now flows against the Volcano Lake levee at an angle of about 90 degrees. Under these conditions, during the flood stage of the river, the Volcano Lake levee would be seriously menaced. In a recent report to the district Mr. Clarke stated that "conditions are rapidly approaching a stage where the Colorado will be uncontrollable from an engineering standpoint." The problem now being considered is that

of turning the river back into the old channel, used prior to the 1910 break. The Ockerson levee, which kept the river in this channel, is in good condition in some places and partly destroyed in others, while at the point where the river now flows through it is totally destroyed for a distance of four or five miles. The report of the engineers was to be laid before the board of directors with a recommendation for immediate action.

Pump Ground Water for Combined Irrigation and Drainage

The advisability of pumping subterranean waters on the Salt River irrigation project, in Arizona, for the double purpose of furnishing an increased supply for irrigation and lowering the present ground-water level to prevent water-logging of the land, is being considered by a board of engineers consisting of W. H. Code and D. W. Murphy, consulting engineers, and W. R. Elliott, project manager. This investigation was begun on account of the necessity for obtaining more water for irrigation. The novel plan of combining this with drainage has been included because frequent trouble is caused by water-logging of irrigated lands. Mr. Elliott writes that by assessment of its members the Salt River Valley Water Users' Association has made available a fund of $500,000, which, it is expected, will permit the installation of 60 to 70 wells and pumping plants. These units will be located adjacent to or connected with the main canals.

Ship Launched in 17 Days, Completed in Twenty-Three

A new record for speed in wooden ship construction has been made in the completion of the "Aberdeen," built by the Grays Harbor Motor Corporation, Aberdeen, Wash., in 23 days, after being launched in 17½ days, as stated in *Engineering News-Record* of Oct. 3, p. 644.

$294,845,170 Advanced to Railways by Administration

Since Apr. 1 $294,845,170 has been advanced by the Railroad Administration to the railroad companies, stated Director General McAdoo. This is exclusive of the current earnings of the roads applied directly by the individual roads to their current expenses and corporation needs. The advances went to 85 different railroads or systems.

Of the total sum disbursed, $209,347,910 was taken from the $500,000,000 revolving fund, and $85,497,200 came from the surplus earnings of a limited number of roads whose receipts for the period exceeded their requirements. The total amount so turned over to the Director General by roads reporting surplus earnings was $113,000,000, to which the American Railway Express Co. added $10,419,944.

The disbursements to the railroads for September aggregated $52,993,750.

General Water Meter System Is Proposed in Philadelphia

An ordinance before the city councils of Philadelphia provides that by Dec. 31, 1924, all water supplied to consumers from the city water-works shall be delivered through meters and charged for at meter rates. As nearly as may be, a fifth of the present unmetered services would be equipped with meters each year for the next four years, and all remaining in the fifth year. Consumers would pay the cost of supplying, setting, maintaining and repairing meters, but the work would be done and the meters controlled by the Bureau of Water. The ordinance authorizes the Director of Public Works to let one or more contracts for installing the proposed meters, under the terms stated in the ordinance, including possible payment in five annual installments. C. E. Davis is chief of the Bureau of Water.

Milwaukee Intake Tunnel and Lake Shaft Connected

Workmen working from the lake shaft connected up on Sept. 24 with the bulkhead end of the Linnwood Ave. tunnel of the Milwaukee water-works. The tunnel was completed in the fall of 1917. It extends 6500 ft. into the lake, and there it connects with a lake shaft 12 ft. in diameter, concrete-lined, sunk to a depth of 150 ft., 66 ft. in water and 84 ft. in the lake bottom. It is expected that the bulkhead will be removed, the short addition of tunnel built and connection made with the shaft within the next four or five weeks. The steel crib used for construction purposes will then be removed and a screen placed on the permanent timber crib, thereby making the tunnel ready for operation.

War Program for Public Health Association Meeting

The program for the annual meeting of the American Public Health Association, to be held at the Hotel Morrison, Chicago, Oct. 14-17, will be very largely given over to war subjects and conditions arising out of the war. Consideration of the war program of the Public Health Service will take up a full session of the meeting on Oct. 15. Surgeon General Blue, Assistant Surgeon Generals McLaughlin, Schereschewsky and Warren and Surgeon J. O. Cobb will outline the plans of the Public Health Service in detail, a general discussion following.

The measure before Congress to establish a sanitary reserve corps and to commission in the Public Health Service men of national prominence in the various phases of health administration will be dealt with, as well as the question of full-time health officers for states and municipalities.

Included in the program of the meeting are the following subjects and speakers: "The Health of the Civil Population in War Time," by Col. V. C. Vaughan, Medical Corps; "Some Public Health Problems and Opportunities Created by the War," by Maj. William H. Welch, Medical Corps; "Team-play for Public Health," by Dr. George E. Vincent, president of the Rockefeller Foundation; "Future of the American Public Health Association," by Dr. Lee K. Frankel, treasurer of the association.

General Goethals Now Member of War Industries Board

Maj. Gen. George W. Goethals has become a member of the War Industries Board, as assistant chief of the General Staff and director of the Division of Purchase, Storage and Traffic. As such his work brings him into close and frequent contact with the operations of the War Industries Board; this his membership will intensify.

General Goethals takes the place on the board formerly filled by his recent assistant, Brig. Gen. Hugh A. Johnson, who has been assigned to a field brigade for active service. General Johnson's position in General Goethals' organization as assistant to the director is being filled by Gerard Swope, of New York.

Let New Contract and Start to Rebuild Destroyed Plant

The work of rebuilding the TNT plant at Morgan Station, N. J., which was wrecked Oct. 4 and 5 by a series of explosions, will be begun at once. While the fire was still burning, and before the last great explosion, officers of the Construction Division and Ordnance Department were discussing the details of the reconstruction. Decision was made in a few minutes and the contract was awarded to T. A. Gillespie Sons & Company.

Laborers have been mobilized and work was started just as soon as the fire was extinguished and all danger from further explosions was past. The work will be done under the supervision of the Construction Division.

Drainage Congress To Meet in Chicago and Kansas City

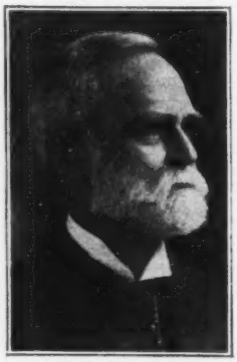
The National Drainage Congress will hold a meeting in Chicago, Oct. 15, at 315 Plymouth Place. The principal officers and those interested in the congress will meet in the morning to discuss the policies and the present action of the drainage interests.

The congress will also hold an informal conference of those interested in drainage and flood protection in Kansas City, Mo., Oct. 17, as an acknowledgment of the invitation of the International Farm Congress and the International Irrigation Congress to attend their joint meeting in Kansas City beginning on that date.

In urging attendance at the Kansas City meeting, an official of the drainage congress says: "We must coöperate with Governmental and other agencies in preparing for the return of our soldiers. Immediate consideration of many grave questions is demanded, and you are urged to attend this meeting not only for your personal interest but in the interest of our country."

Committee on Development, American Society of Civil Engineers

THOMAS LEE WILKINSON, consulting engineer, Denver, appointed by the Colorado Association, has been secretary and general manager of the Intermountain Railway, Light & Power Co. since 1909. 1891-1894, on machinery design for M. C. Bullock Mfg. Co., Chicago and Joliet plant, Illinois Steel Co. Since 1894, in general engineering practice at Denver. Assistant general manager and engineer, Southwest Smelting & Refining Co., Orogrande, N. M., 1905. Past-president Colorado Scientific Society, Denver. Born in 1867.



S. EVERETT TINKHAM, appointed by the president, is engineer of construction, bridge and ferry division, Public Works Department, Boston. Continuously in service of engineering department, Boston, since 1874. Secretary of Boston Society of Civil Engineers since 1880, and represented society on board of managers, Association of Engineering Societies, from its formation in 1881 until withdrawal of the society from the association in 1914. For a number of years, chairman of the board of managers of the association. Born in 1852.

EDGAR B. THOMAS, appointed by the Cleveland Association, has been engaged in private practice for the past four years as a consulting engineer with headquarters in Cleveland. With the city engineering department, Cleveland, for 15 years, advancing from transitman to chief engineer. President Cleveland Engineering Society and member special engineering committee on improvement of Cuyahoga River, Civic League Paving Committee, Cleveland Council of Sociology, Cleveland Chamber of Commerce. Born in 1870.

ONWARD BATES, Chicago, past president, American Society of Civil Engineers (1909-1910), appointed by the president as chairman of the committee, has been engaged in private practice as a consulting engineer since his retirement from the Bates & Rogers Construction Co. in 1908. 1865-1868, apprentice in pattern making. 1868-1871, draftsman and inspector of bridge work, and foreman on construction of caissons, Eads Bridge, St. Louis. Student in Rensselaer Polytechnic Institute, 1871-1873. Engaged in bridge and iron work from 1878 to present time, three years of which were spent in Australia. From 1888 to 1901, engineer and superintendent of bridges and buildings, Chicago, Milwaukee & St. Paul Ry. Past eight years, trustee, Chicago Bureau of Public Efficiency. President Western Society of Engineers, 1899. Born in 1850.

H. L. HAEHL, appointed by the San Francisco Association, has been a member of the firm of Duryea, Haehl & Gilman, consulting engineers, San Francisco, since 1907. 1901-1902, assistant professor of geology, Leland Stanford Jr. University. 1902-1906, with Bay Cities Water Co., San Francisco, as draftsman and assistant engineer. 1906 became first assistant engineer, development of San Francisco water-supply in Sierra Nevadas. President San Francisco Association, 1916. Born in 1876.

ARSENE PERRILLIAT, appointed by the Louisiana Association, is a consulting engineer, with headquarters in New Orleans, specializing in canal, levee and land reclamation work. 1885-1888, assistant professor of physics, mathematics and chemistry, Tulane University. Chief of engineers, Louisiana National Guard, 1905; later chief of ordnance, with rank of brigadier-general. Representative United States Government, International Congress of Navigation, Paris, 1900; St. Petersburg, 1908. Sent to Holland by United States Government, 1906, to study dike and levee protection. Member of International Commission for relief of Belgium. Born in 1865.

GEORGE GRAY ANDERSON, appointed by the Southern California Association, was previously consulting engineer for the Imperial Irrigation District and has specialized in irrigation, water-supply and valuation work for 38 years. Has made studies and reports on Canadian Pacific irrigation projects, Alberta, for Canadian Pacific Ry.; issues in controversy between Canada and United States on diversion of water from St. Mary's River, for Dominion Government; Trinchera Irrigation District, Colorado; and Salton Sink. Made valuations of Beaver Land & Irrigation Co., Colorado; Denver Union Water Co.; and Spring Valley Water Co. Born in Scotland, 1858.

CHARLES J. TILDEN, appointed by the Baltimore Association, is professor of civil engineering, School of Technology, Johns Hopkins University. Instructor in engineering department, Harvard University, 1897. 1897-1901, structural draftsman and bridge inspector. 1901-1903, assistant engineer, Rapid Transit Commission, New York City. Instructor in civil engineering, Cornell University, 1903. Instructor in civil engineering, University of Michigan, 1905; assistant professor, 1906; junior professor of civil engineering, 1908; professor of engineering mechanics, 1911. Born in 1873.

FRANK T. DARROW, Lincoln, Neb., appointed by the Nebraska Association, is assistant chief engineer, Chicago, Burlington & Quincy R.R. In service of Burlington since 1897 on location, construction, maintenance and bridge work; appointed principal assistant engineer, 1907; engineer, maintenance of way, lines west, 1908; assistant chief engineer, August, 1918. Born in 1875.

HARRY R. SAFFORD, until recently of Montreal, appointed by the president, was chief engineer of the Grand Trunk Ry. until a short time ago, when he became assistant to the regional director, Central Western Region, United States Railroad Administration, Chicago. In engineering department of Illinois Central R.R., 1895-1910, as rodman, instrumentman, assistant engineer, roadmaster, assistant chief engineer and engineer maintenance of way. Appointed chief engineer of the Grand Trunk Ry. in 1911. Born in 1875.

WILLIAM L. DARLING, appointed by the Northwestern Association, has been engaged in private practice in St. Paul since his return from Russia, where he went in 1917 as a member of the Railway Commission, headed by John F. Stevens. Beginning 1878, was on original construction of Northern Pacific Ry., through North Dakota and Montana, rising through various grades and becoming chief engineer in 1901. Chief engineer Chicago, Rock Island & Pacific Ry., 1903. Chief engineer Chicago, Milwaukee & Puget Sound Ry., 1905, then again chief engineer Northern Pacific Ry.; resigned 1916. Born in 1856.

PAUL G. BROWN, New York City, appointed by the president, has, since 1908, been at the head of the Cuban Engineering and Contracting Co., engaged in sanitary work for the Cuban Government. Is at present also doing Government work for Emergency Fleet Corporation. 1894-1900, assistant engineer and engineer in charge, Bureau of Engineering, Chicago, on tunnel and crib work. 1901-1904, engineer, W. J. Gawne & Co., tunnel work at Cincinnati. Since then has been engaged in tunnel, railway terminal and canal work, Pennsylvania crosstown tunnels, Grand Central Terminal, and New York State Barge Canal. Born in 1870.

CLIFFORD M. HOLLAND, Brooklyn, N. Y., appointed by the president, is division engineer in charge of construction of tunnels, East River, First District, Public Service Commission, State of New York. Continuously in service of Rapid Transit and Public Service Commissions since 1906; first as assistant engineer in subway and tunnel work. Became tunnel engineer, East River tunnels, 1915. Made division engineer 1917. Born in 1883.

GEORGE C. MASON, appointed by the Portland (Ore.) Association, is at head of the Hurley Mason Co., building contractors, Portland. 1892-1904, New York University. Organized Hurley Mason Co. in 1904 for contracting and engineering work with offices in Tacoma, Seattle, Spokane and Portland. State chairman Associate Members of United States Naval Consulting Board; member Civil Service Commission, Portland. Born in 1871.

J. H. BRILLHART, Dallas, appointed by the Texas Association, is president and manager of the Texas Structural Steel Co. and chief engineer of the Mosher Manufacturing Co., Dallas. 1905-1912, with Guerber Engineering Co., Bethlehem, Penn., as tracer, detailer, designer, checker, assistant engineer and chief engineer. Chief engineer Mosher Manufacturing Co., 1912. President and manager Texas Structural Steel Co., 1915. Born in 1880.

W. H. HOYT, Duluth, Minn., appointed by the Duluth Association, has been assistant chief engineer of the Duluth, Missabe & Northern Ry. since 1905; in the service of that company since 1905, first as assistant engineer. 1890-1892, in private practice. 1892-1896, assistant engineer, Duluth & Iron Range R.R. 1896-1900, U. S. Engineer's Office, Duluth. 1901-1903, principal assistant city engineer, Duluth. Born in 1867.

CHARLES HANSEL, New York City, appointed by the President, is a consulting engineering specializing in railroad valuation work. Was chief engineer of Wabash Ry. 1884-1899. Later made appraisals for the states of Illinois and Michigan, and appraisal of all railroads and canals in New Jersey. Now consulting valuation engineer for Pennsylvania, Philadelphia & Reading and Jersey Central systems. Born in 1859.

EDGAR S. NETHERCUT, Evanston, Ill., appointed by the Illinois Association, is secretary of the Western Society of Engineers. 1889-1893, architectural and structural draftsman. 1893-1907, chief engineer and sales manager, Paige Iron Works and Buda Co., Chicago. 1908-1911, track expert, valuation department, Public Service Commission, First District, New York. 1911-1914 in private practice, headquarters Chicago, engaged in steam and electric railway valuation, sewer and building construction. Made valuation of Washington Ry. & Electric Co., Washington, D. C. Born in 1866.

BAXTER L. BROWN, appointed by the St. Louis Association, has been engaged in private practice in St. Louis since 1905, previous to which was chief engineer of the St. Louis Valley Ry. for four years. 1882-1901, engaged in railroad location, construction and maintenance work in various capacities from rodman to assistant chief engineer. 1912 and 1913, retained by City Plan Commission, St. Louis, to report on development of river front. 1916, member committee for preparation of plans for St. Louis Chamber of Commerce, relative to general industrial and civic improvement of city. Born in 1864.

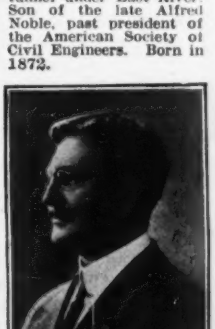
GEORGE BUTLER, appointed by the San Diego Association, is county surveyor, San Diego County. 1887-1888, draftsman, instrumentman and computer, engineering department, Colorado Springs, Colo. 1889-1891, assistant to chief engineer, Hartford Loan & Trust Co., and in general practice, vicinity of Denver. 1891-1907, with U. S. Indian Bureau, Interior Dept., as draftsman, special disbursing agent, principal assistant in charge design of structures, superintendent of irrigation, general superintendent in charge of irrigation, water supply, sewerage, and other works for Indian Bureau. Private practice, San Diego, 1907. County surveyor, San Diego County, 1907. Born in 1864.

ARTHUR PEW, appointed by the Atlanta Association, is a consulting engineer with headquarters in Atlanta, specializing in water-supply, sewerage, railroad and appraisal work. Has made many valuations of public utility properties and reports on improvement of efficiency of industrial plants. Has been in charge of design and construction of a number of municipal and private projects. Elected member American Society of Civil Engineers, 1885.

RICHARD L. HUMPHREY, appointed by the Philadelphia Association, has for the past 10 years been engaged in practice as a consulting engineer, with headquarters in Philadelphia, specializing in cement mill and concrete construction, and is now chief of the Building Materials Section, War Industries Board, Washington, D. C. 1891-1899, with Department of Public Works, Philadelphia, and as engineer in charge, Philadelphia Municipal Testing Laboratory. 1899-1903, engineer and general manager, Buckhorn Portland Cement Co. 1908, in private practice. Born in 1869.

GARDNER S. WILLIAMS, appointed by the Detroit Association, is a consulting engineer, specializing in hydro-electric development, water-power and water-supply work, with headquarters in Ann Arbor, Mich., and Chicago. 1898-1904 professor of experimental hydraulics, Cornell University; 1904-11 professor of hydraulic and sanitary engineering, University of Michigan. Born in 1866.

GEORGE R. PUTNAM appointed by the District of Columbia Association, is commissioner, Bureau of Lighthouses, Washington. Engineering department, Chicago, Rock Island & Pacific Ry., 1883. In 1890 entered service United States Coast & Geodetic Survey; on Mexican and Alaskan boundary surveys; on expedition to Greenland as astronomer, 1896; on survey Pribilof Islands, Bering Sea, 1897, and delta Yukon River, 1898-1899. 1900-1906, director of Coast Survey, Philippine Islands. First commissioner of lighthouses, 1910. Author of works on nautical charts and lighthouses. Born in 1865.



FREDERICK C. NOBLE, New York City, appointed by the president, is a consulting engineer having a general practice. In the service of the city of New York from 1900 to 1914 on bridge, subway and tunnel work, during which time he was division engineer for construction of the first rapid transit tunnel under East River. Son of the late Alfred Noble, past president of the American Society of Civil Engineers. Born in 1872.

JOHN L. HALL, appointed by the Seattle Association, is a consulting engineer with headquarters in Seattle. From 1896 to 1916, associated with Purdy & Henderson, from which he resigned as vice-president in charge of the Pacific Coast territory in 1916, remaining, however, as a member of the board of directors. Born in 1860.

ROBERT A. CUMMINGS, appointed by the Pittsburgh Association, is a contractor and consulting engineer specializing in concrete and harbor work. President, Cummings Concrete Construction Engineering Co., now engaged in building concrete barges for New York State Barge Canal. Originator of Cummings System of Reinforced Concrete. Born in 1866.

JOHN C. RALSTON, appointed by the Spokane Association, is a consulting engineer with headquarters in Spokane and was previously city engineer of that city. 1891-93, on railroad survey and construction work in the Northwest; later, erecting contractor, Chicago Elevated Railways. 1896, in private engineering practice, northwest territory. Born in 1867.

The FIRST THREE LOANS MADE *the* MARNE VICTORY POSSIBLE

You felt mighty happy a few weeks ago when you read about the way we pushed 'em out of the Marne salient, didn't you?

Made you feel pretty good to know that you were in on that We thing, didn't it?

The rest of us felt that way about it, too.

The fellows over there didn't seem so far away, somehow or other.

And the war sort of seemed to be our business after that, a job we had to do.

Well, here's another chance for us to get busy and make a bigger victory possible — and make it stick to the end of time.

Let's keep close behind those boys of ours. Let's buy another bond today—the biggest bond we can.

We've got the whole Potsdam family on the run.

Another Liberty Bond or two or three or four will help finish the job—Let's do it up right.

Let's buy to the limit—and put the Kaiser out of business.

Lend the way they fight—Buy Bonds to your utmost!

$13,000,000 Insurance for Employees Taken by Shipyard

The Skinner & Eddy Shipbuilding Corporation, Seattle, has announced that arrangements have been made for placing $13,000,000 in life insurance, representing a $1000 policy for each of the 13,000 employees of its two shipbuilding plants. This announcement was made on the second anniversary of the launching of the company's first vessel, the 8800-ton steel steamship "Niels Nielsen."

New employees will receive policies after 60 days in the company's service. The premiums are paid by the company, and the insurance in no way affects awards made under the state workmen's compensation act.

Draftsmen Wanted in Air Service

The air service of the United States Army is in need of draftsmen, as well as of men in many other trades and professions, says the headquarters of the air service for the Eastern department. It is stated that men from 18 to 45, registered in the draft, are eligible, and in making application should give full details as to serial number and local board under which they are registered. Applications should be made to Lieutenant Billker, Room 902, 104 Broad Street, New York City.

Imperial All-American Canal

The Imperial All-American Canal Association of Los Angeles has been organized in that city for the purpose of working for the installation of a canal system in the Imperial Valley at a higher altitude than the present system, and wholly in California. The lands to be served by the proposed new canal system are situated in Imperial and Riverside Counties and are not now producing because they lie above the present Imperial Valley canal system.

George F. Kapp is president of the association and Charles F. Price is secretary.

Municipal Improvements Meeting

(Concluded from page 686)

read a paper prepared by himself and F. W. Mohlman on experiments with the Miles acid process of sewage treatment carried out under their direction by the City of New Haven, Conn. The process seems to have much to recommend it under local conditions existing at New Haven, but it presents difficulties which, according to present indications, would bar its use in some other cities.

Rudolph Hering opened the discussion on these papers. Two factors enter into sewage disposal, prevention of nuisance, which is easy, and protection of public health, which includes problems not yet solved. Bacterial standards have been suggested, first according to numbers, later as to kinds. B. coli is now the measure. Before spending millions of the people's money we must go farther than the B. coli standard. It may be that 500 B. coli per c.c. will give us typhoid, but it is not the coli that will do it. As engineers we must see this matter very clearly before spending millions to reduce bacteria to any fixed standard. Engineers must urge bacteriologists to go further in their studies.

Specification Committees' Reports

For the subcommittee on bituminous pavements A. W. Dow, New York, acting chairman, reported that the other members of the committee were all in Government service. He submitted entirely new specifications to take the place of those adopted two years ago at Newark. This report, like the others which included new specifications or amendments to old ones, was ordered sent to letter ballot. Specifications for surface treatment of broken stone and gravel roads with cold bituminous material, designed to conserve fuel, were submitted by Prof. A. H. Blanchard, New York City. Slight changes were recommended in the specifications for brick and wood-block pavements, and no changes in stone block or sewer specifications. There was no report from the committee on concrete pavement specifications. On motion of Mr. Dow, it was decided to request the chairmen of the various paving specification committees to confer and report on the desirability of providing specifications for foundations of materials other than concrete, with power to draft such specifications if deemed advisable.

The convention voted not to copyright the society specifications this year.

Twenty-Fifth Jubilee Addresses

Addresses reviewing the history of the society since its foundation 24 years ago were made by Pres. N. S. Sprague, Sec. C. C. Brown and Past-Sec. George W. Tillson. It was pointed out that the membership and the topics discussed extended more generally over the whole municipal field in the earlier than the later years. The rise, work and final amalgamation with the society, a few years ago, of the Association for Standardizing Paving Specifications, was sketched. This amalgamation gave a new impetus to the society.

The election of officers, in accordance with the report of the nomination committee, resulted in the choice of E. R. Conant, Savannah, Ga., as president; G. H. Norton, Buffalo, first vice president; R. Keith Compton, Baltimore, second vice president; W. J. Hardee, New Orleans, third vice president. C. C. Brown, Bloomington, Ill., was reelected as secretary, and F. J. Cellarius, Dayton, Ohio, as treasurer.

For the next meeting place New Orleans was tentatively chosen, the convention to be held in October or November, the exact date to be chosen by the executive committee. The committee was authorized to postpone the meeting if conditions a year hence made it seem advisable to do so.

War-Time and Reconstruction Resolutions

The convention adopted resolutions expressing (1) its desire to coöperate to the full extent with the Government agencies in all measures which may hasten the winning of the war, and requesting that individual engineers exert their influence toward deferring all public improvements which, although perhaps of considerable local importance, should not be considered as essential under war conditions; (2) expressing the belief that state, county and municipal governments should undertake at once the planning of important works which it may be practicable to construct soon after the declaration of peace; (3) requesting the President of the United States to appoint a commission on reconstruction to coöperate with the British Ministry on Reconstruction; (4) also requesting careful consideration by the United States Highways Council and the various State Highway Departments of the urgent necessity for greater latitude in the release of highway materials, so that the highway systems may be maintained against destructive loss. It was voted to send copies of the resolutions to the United States Highways Council and to the highway department of each state.

Engineering Societies

The Detroit Engineering Society, at its meeting Oct. 4, was addressed by J. F. Rawlinson, Detroit representative of Lloyds' Register of Shipping, on "The Submarine and Its Use." The meeting of Oct. 18 will be addressed by J. E. Freeman, engineer Portland Cement Association, Chicago, who will speak on "Concrete Ships."

The Mechanical Section of the Cleveland Engineering Society has been established by the American Society of Mechanical Engineers as its Cleveland section. The petition for the formation of this section was signed jointly by members of the local society and of the national society resident in Cleveland and adjacent cities and towns.

The Brooklyn Engineers' Club held its regular meeting for October on Oct. 10. A paper on "The Modern Technical High School" was presented by Albert L. Colsten. It dealt with representative technical high schools in the United States, including the earlier manual training school, the four-year technical high school and the two-year trade school. The paper also dealt with the proposed four-year technical high school for Brooklyn. The next informal meeting of the club will be held Oct. 17. A paper will be read by Albert H. Hager, manager for the Atlantic Gulf and Pacific Co., New York, on "The Mill Basin Development."

Calendar

Annual Meetings

AMERICAN PUBLIC HEALTH ASSOCIATION; 126 Massachusetts Ave., Boston, Oct. 14-17, Chicago.

CITY MANAGERS' ASSOCIATION; Harrison Grey Otis, Auburn, Maine, secretary-treasurer; Nov. 6-8, Roanoke, Va.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS; A. Dennis Williams, Morgantown, W. Va., acting secretary; Dec. 2-6, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS; 29 West 39th St., New York City; Dec. 3-6, New York.

Personal Notes

John W. Twohy of Twohy Brothers, engineers and contractors, Seattle, has become general manager of the Seattle, North Pacific Shipbuilding Company.

Philip P. Farley, formerly president of the Jamaica Bay Improvement Commission and consulting engineer of the New York State Highway Department, who has been engaged in private practice for the past three years, has been named consulting engineer for the Borough of Brooklyn, New York City.

Otto E. Eckert of the engineering division, Michigan State Board of Health, and formerly assistant city engineer of Saginaw, Mich., has been appointed acting state sanitary engineer.

Col. Herbert Deakyne, Corps of Engineers, U. S. A., who for four years previous to 1915 was in charge of the Missouri River improvement work between the mouth of the river and Sioux City, has been promoted to the rank of brigadier general.

A. O. Peabody, formerly with the Acheson Graphite Co., Niagara

Falls, N. Y., and recently in charge of construction and maintenance for the New Mexico State Highway Commission, has been appointed bridge engineer for the commission, succeeding L. O. Martin, who has resigned to enter war work.

PETER A. DALY, North Bergen, N. J., has been placed in charge of the extensive improvements now being made on the Newark turnpike.

JAMES F. McINDOS, formerly colonel, Corps of Engineers, U. S. A., is now a brigadier-general.

S. A. SIVERTS, JR., city manager of Morris, Minn., for the past four years, has resigned to enter the Engineer Officers' Reserve Corps, with the rank of first lieutenant.

KENNETH ALLEN, sanitary engineer, Board of Estimate and Apportionment, New York City, has become district engineer, Bureau of Industrial Housing and Transportation, with headquarters at Washington.

A. D. WHIPPLE, chief engineer of the structural bureau of the Portland Cement Association, has become chief engineer of the Lime Association, with headquarters in Washington.

ALBERT E. GHYSENS has been appointed city engineer of Verdun, Quebec.

J. R. LEIGHTY, engineer maintenance of way of the Missouri Pacific Ry. at Kansas City, has been appointed chief engineer of the corporation, with office in St. Louis.

P. J. NEFF, formerly district engineer of the St. Louis-San Francisco Ry. at Springfield, Mo., has been appointed engineer for the corporation, with office in St. Louis.

N. W. H. SCHAFER, JR., supervisor of the Philadelphia & Reading Ry. at Lebanon, Penn., has been appointed division engineer at Harrisburg. He succeeds John S. Goodman, who is transferred to Tamaqua, Penn. Mr. Goodman succeeds W. D. Kenzie, transferred to Reading and succeeding in turn John C. Wrenshall, Jr., transferred to Philadelphia.

J. Q. BARLOW, formerly assistant chief engineer of the Southern Pacific Co., has resigned.

FRANK J. RADIGAN, assistant engineer, engineering department, Jersey City, N. J., has been appointed assistant county engineer of Hudson County, New Jersey.

COL. SHERWOOD A. CHENEY, Corps of Engineers, U. S. A., has been made a brigadier-general.

JAMES A. JOHNSON, contractor, Seattle, has been appointed superintendent of buildings of that city, succeeding T. Josenhans, resigned.

CAPT. F. A. DALLYN, provincial sanitary engineer of Ontario for some years past, started for Siberia with the Canadian Expeditionary Force on Oct. 3, to serve as a water-supply engineer.

COL. AVERY D. ANDREWS, Corps of Engineers, U. S. A., is one of the new brigadier-generals, recently promoted.

H. F. BLOMQUIST, for the past seven years city engineer of Mankato, Minn., has resigned to become principal assistant engineer, Bureau of Water Supply, St. Paul.

HARVEY S. DARTT, for the past eleven years city engineer of Owatonna, Minn., has resigned to become city engineer of Mankato, Minn., succeeding H. F. Blomquist, who has resigned to become principal assistant engineer, Bureau of Water Supply, St. Paul, as mentioned above.

EDWARD C. SHERMAN, designing engineer and project manager, Bureau of Yards and Docks, U. S. N., has been commissioned as lieutenant commander, Corps of Civil Engineers, U. S. N. R. F., and assigned to duty in the same work, with headquarters in Washington, D. C.

CAPT. JOHN P. WENTWORTH, Sanitary Corps, U. S. A., formerly assistant engineer for Metcalf & Eddy, Boston, has been assigned to duty as camp sanitary engineer at Camp Wheeler, Macon, Ga.

EDWARD WRIGHT, JR., assistant engineer, Massachusetts State Department of Health, has been commissioned as captain in the Sanitary Corps and assigned to duty at Fort Oglethorpe, Georgia.

COL. CHARLES D. DAWES, Corps of Engineers, U. S. A., is now Brigadier-General Dawes.

HORACE J. COOK, resident engineer for Metcalf & Eddy, Boston, and formerly assistant superintendent of the Kennebec Water District, Waterville, Me., has been commissioned as captain in the Quartermaster Corps and assigned to duty at Camp Cody, Deming, N. M., in charge of camp utilities.

HOWARD J. JACKSON, engineer, water resources branch, United States Geological Survey, has resigned to devote his full time to work as special agent of the Northwestern Mutual Life Insurance Co., with headquarters at Washington, D. C.

S. S. STEINBERG, South Carolina State Highway Department, and formerly assistant engineer, New York State Highway Department, has become assistant professor of civil engineering at Maryland State College, College Park, Md.

W. H. FRANKLIN, assistant general superintendent, James Black Masonry & Contracting Co., has been commissioned as first lieutenant in the construction division, Quartermaster Corps, and assigned to duty at Mays Landing, N. J.

OBITUARY

CAPT. JOHN BELLAMY, 103rd Engineers, U. S. A., has been killed in action in France. He was struck by a shell while walking back of the lines. He was formerly employed in the engineering department of the Lackawanna R.R., with headquarters at Scranton, Penn.

CHARLES GUSTAVUS ROEBLING, who with his brother, Washington Augustus Roebling, completed the construction of the Brooklyn Bridge, started under contract by their father, John A. Roebling, died Oct. 5 in Trenton, N. J., in his seventieth year. Mr. Roebling was president of the John A. Roebling Sons Co., Trenton and Roebling, N. J., and of the New Jersey Wire Cloth Co., Trenton, and vice president of the John A. Roebling Sons Co., New York. He was engineer and builder of the Oil City Suspension Bridge at Oil City, Penn.; in 1881 he was engineer of the machinery and contractor for the removal of Cleopatra's Needle from Alexandria, Egypt, to Central Park, New York City, and in 1902 was the contractor and builder of cables for the Williamsburg suspension bridge.

Mr. Roebling was the founder of the model town of Roebling, N. J., on the Delaware, designed originally for the employees in the wire and steel mills. Among Mr. Roebling's achievements in the industrial growth of the John A. Roebling's Sons Co. are the construction and operation of seven large wire mills, the largest rod mill in the country, an open-hearth and steel plant of twelve furnaces, a billet mill, many tempering and tinning furnaces, a large cloth factory and great mills for making flat steel wire.

Mr. Roebling was a member of the legislature of New Jersey in 1903, and presidential elector for New Jersey in 1904. He was a member of the Iron and Steel Institute of Great Britain and of America, of the American Institute of Mining Engineers, and of the Engineers' Club, New York.

JAMES MURRAY AFRICA, city engineer of Huntingdon, Penn., died at his home in that city Sept. 18. Mr. Africa entered engineering work in 1882 on surveys and topographical work in Huntington County, Pennsylvania. He was first elected city engineer of Huntingdon in 1884, serving for four years. Soon after this time he designed the water-works for the city as well as water-works for Palmyra and Riverton, N. J. In 1888 he became assistant engineer of the Chautauqua Lake R.R., and soon afterward became chief engineer and general manager of the road. In 1894 he became chief engineer of the Pennsylvania Midland R.R., at the same time serving as city engineer of Huntingdon.

NEWS OF ENGINEERING INDUSTRIES

FOR MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Metal Trades Leaders Thrash Out Many War Problems

A drive to increase America's production of iron and steel, at the same time releasing man power for military service, by the installation of labor-saving machinery, was launched at one of the largest gatherings of metal working manufacturers ever assembled, held at Milwaukee, Oct. 7, in attendance at the five-day congress of the American Foundrymen's Association and the American Institute of Mining Engineers.

Charles M. Schwab, director general of the Emergency Fleet Corporation, reviewed the progress of the shipbuilding campaign of the past year, pointing out the present need for carrying the program to a successful conclusion. Many problems were considered at the meeting, including labor, proper distribution of coal and coke, closer coöperation with and between the Fuel and Railroad Administrations, and the employment of women in war work. The Auditorium was filled with machinery of all description used in the metal industry.

Improvements Urged In Export Lumber Trade

Suggestions for improvement of the present methods employed in the export lumber trade of the United States are contained in a report just made public by the bureau of foreign and domestic commerce, Department of Commerce. It states that the most serious complaint made against American lumber has been in regard to qualities, and has been due largely to hurried or inefficient grading and lack of adequate grading rules recognized in both foreign and domestic markets. It is pointed out that comparatively few mills in this country have specialized in cutting for export trade or have endeavored to market their product abroad on their own accounts.

The report points out that when the war is over the subject of export trade will become an important one to the lumber industry, and the constructive criticisms in the Government's report are aimed solely at assisting in the necessary preparation for meeting conditions as they will exist when the demand for reconstruction materials makes itself felt. The report contains in detail practical suggestions as to methods of developing and improving the foreign lumber trade. Copies may be obtained for 20c. each from the Superintendent of Documents, Washington.

That lumber manufacturers expect to play a material part in furnishing building materials for rehabilitating devastated Europe is shown in a report recently issued by Dwight Davis, representative of the West Coast Lumbermen's Association, which includes the statement that this project had gone as far as a survey of lumber needs, showing that 7,000,000,000 feet will be required for the work.

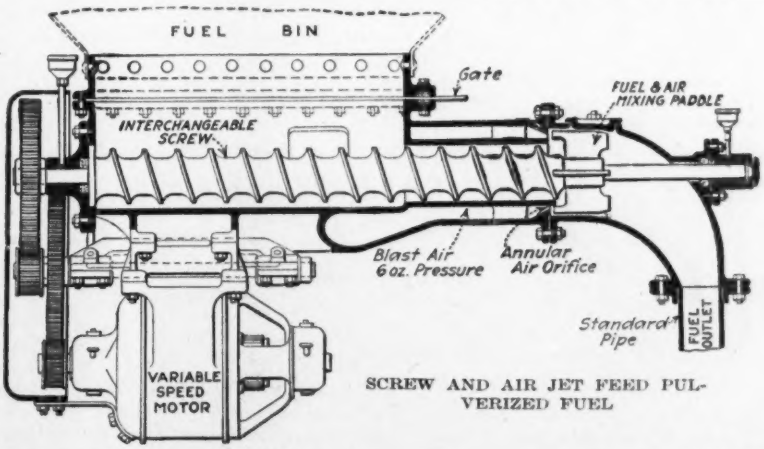
Quotas of Coal Production Pledged By Mines

Reports being received by the Fuel Administration indicate a general acceptance of the weekly production quotas of operators, fixed by Fuel Administrator Garfield as a means of stimulating supply throughout the Eastern part of the country, where the need of increased production is at present the greatest.

In the Pocahontas and Tug River fields in West Virginia the miners and operators joined in a pledge to mine 2,000,000 tons in October, which represents an increase of 300,000 tons over the large August production, in spite of the fact that 5000 mine workers have left this territory since May 1.

Feeding-Mixer, With Screw Conveyor, for Pulverized Coal

A screw conveyor with air jet and mixing paddle constitutes a combination feeder and mixer for delivering pulverized fuel to boilers, kilns or furnaces. Under the bottom of the fuel bin is a horizontal screw of coarse pitch and giving such length of contact as to prevent clogging. On the discharge end of the shaft is a revolving paddle.



SCREW AND AIR JET FEED PULVERIZED FUEL

Around this end of the conveyor is an annular orifice through which air at 6 lb. pressure is blown through the paddle, which thus effects an intimate mixture of the air and fuel. This mixture under pressure is discharged into the nozzle at the combustion chamber.

Noiseless gears of steel and rawhide transmit power from a variable-speed motor to the screw shaft and a blower furnishes air for feeding and mixing. Feed is controlled by varying the speed of the motor. A 5-in. feeder with screw of 3½-in. pitch has minimum and maximum capacities of 850 and 3400 lb. per hour, with 12 intermediate rates. Feeders of different sizes deliver from 60 to 4000 lb. per hour. This device is known as the "Lopulco" feeder and is manufactured by the Locomotive Pulverized Fuel Co., New York.

Industries Reclassified Under Recent Ruling

The priorities division of the War Industries Board has issued circular No. 20, which contains preference list No. 2, superseding preference list No. 1 issued Apr. 6. It contains all amendments and supplements to the previous list.

The first 11 pp. contain the classification of industries as made by the recent ruling of the War Industries Board, and those following have an alphabetical list by states of individual plants working on Government contracts, naming the towns in which they are situated and the numbers of their respective classifications. In it is also included a list of fuel supply priorities.

Could Save 110,000 Barrels of Fuel Oil Daily

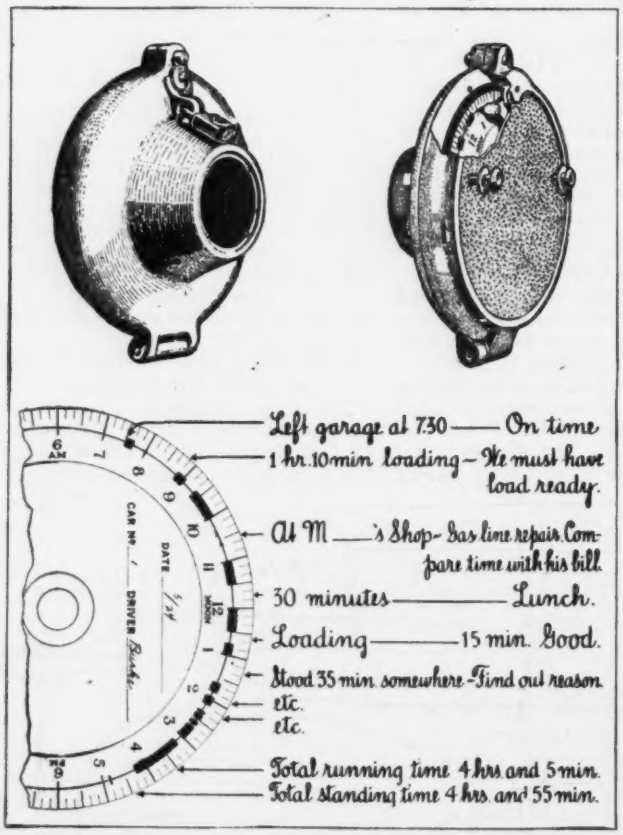
By more intelligent operation of plants and proper firing, 110,000 bbl. of fuel oil per day, or 40,000,000 bbl. per year, might be saved of the present annual consumption of 160,000,000 bbl., according to conclusions just reported which have been drawn by experts of the bureau of mines, Department of the Interior. These experts have been cooperating with the Fuel Administration in a general survey of the use of fuel

oil for power purposes in the United States. Their conclusions indicate that the annual wastage of fuel oil represents a needless expenditure of $140,000,000 per year.

As one result of the investigation a handbook for plant engineers in the efficient use of fuel oil has been issued by the Bureau of Mines. It gives instructions to all who have oil-burning plants.

Elapsed Time Recording Device For Motor Trucks

The efficiency of a motor truck is more or less inversely proportionate to the time in which it is idle. Rapid loading and unloading devices, trailers, etc., are all for the purpose of keeping the trucks moving and reducing such overhead items in the unit cost as driver's salary, etc. Proper supervision to see that trucks return from trips promptly, and inquiries as to the reasons for delay if they do not, are, if properly conducted, efficient means for lowering the unit cost of operating the trucks.



TIME RECORDING DEVICE FOR MOTOR TRUCK

An appliance has been produced by which the actual running time of the trucks may be recorded. The device consists of two essential elements, a pendulum which will swing from side to side in response to the side sway of the moving vehicle and a chart, rotating at clock speed, upon which the pendulum records the side sway which indicates that the truck is in motion. The absence of this record, therefore, shows that the vehicle is not moving. The motion is recorded on the disk by means of the stylus that is set in motion by the pendulum near its point of suspension. The disk records are turned in for the daily inspection of the truck superintendent, dispatcher or higher official, who, being familiar with the duties the truck must perform, identifies the various trips and stops as shown in the chart. Stops or delays for which there is no apparent reason can then be noted, inquiries made and the elimination of unnecessary causes effected. These may be small, but they can accumulate to large proportions in the case of the use of a large number of trucks.

America Has Advantage in Promising African Trade

Starting with an advantage, owing to the already established high reputation of certain goods, the United States has an opportunity for trade with an African country rich in resources, according to a bulletin of the Bureau of Domestic and Foreign Commerce. The bulletin states that "even far-off Abyssinia has trade possibilities that should be studied now and developed as soon as the war is over."

The country is wealthy in natural resources, has a comparatively good climate and is populated by eight or ten millions, intelligent and aggressive, the report states. It expresses the opinion that the possibility of a more economic and industrial development does not obtain in any other portion in the world with equal commercial opportunity, and although the trading population is relatively small the merchants in that class are intelligent and observant.

The advantage now enjoyed by Americans there is on account of the establishment of a nation-wide reputation in cotton goods, so well known that in portions of the country they are used as a medium of exchange.

The railway extensions in other parts of Central Africa, especially the connections along the Congo River with the so-called Cape-to-Cairo route, are opening up other large territories of wide trade possibilities, according to commerce bureau reports.

Business Notes

The Lidgerwood Mfg. Co. announces that it has opened a branch office in the Union National Bank Bldg., Cleveland, Ohio, for the better handling of its mine hoists, contractor's hoists, derricks and cableways. The office will be in charge of Ernest F. Pegg, recently associated with the W. M. Pattison Supply Co.

The American Steel Export Co. announces the opening of its own office at 1203 Smith Building, Seattle, Wash., for the convenience of its customers on the Pacific Coast. M. R. Rosse, Pacific Coast sales manager, will be in charge.

Albert W. Russel, former president of the Russel Motor Axle Co., and later connected with the office of the Secretary of War, has been appointed a member of the War Credits Board, to fill the vacancy caused by the resignation of F. P. Neal.

The R. H. Beaumont Co., Philadelphia, Pa., has issued Catalog No. 38 describing and illustrating the Beaumont Drag Scraper System for the ground storage of coal.

Trade Publications

The Standard Asphalt and Refining Co., 208 So. La Salle St., Chicago, has recently issued a publication, "Sarco Mineral Rubber Asphalts." It contains illustrations of the application of "mineral rubber" for insulation, waterproofing and protection purposes.

The Pittsburgh Water Meter Co., East Pittsburgh, Penn., has issued a 42-p. catalogue entitled "Water Meters." It is illustrated with halftones and line cuts.

"Improvements in Water Wheel Efficiency," is the title of a pamphlet issued by the Pelton Water Wheel Company, San Francisco, Calif. It is illustrated with plant views and diagrams, and is based on studies made by E. C. Hutchinson, Chief Engineer of the Pelton Water Wheel Company.

The C. W. Hunt Co., Inc., New York City, has issued bulletin 18-2 containing descriptions and illustrations of its standard storage battery industrial trucks.

First
Devo